ADEQ Arizona Department of Environmental Quality

# Arizona's 2011 Nonpoint Source Annual Report

## Nonpoint Source Program July 1, 2010 - June 30, 2011

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# I. Purpose and Goals

## Purpose of Report

Arizona's Nonpoint Source (NPS) Annual Report for Fiscal Year 2011 presents a synopsis of the Arizona Department of Environmental Quality (ADEQ) NPS Program activities for fiscal year 2011 (July 1, 2010 through June 30, 2011). The majority of work performed by ADEQ's NPS Program is funded by Clean Water Act Section 319(h) grant monies, awarded by the U.S. Environmental Protection Agency (EPA). Throughout this report, ADEQ provides a summary of progress in obtaining short- and long- term goals identified in the Arizona NPS Five –Year Management Plan (NPS Management Plan), as well as information for evaluating progress and improving the program in the future. The current NPS Management Plan is available for viewing and download on the ADEQ Web site at: http://www.azdeq.gov/environ/water/watershed/download/NPS_5-Year-Plan-2010-14.pdf.

## Arizona's Nonpoint Source Program

ADEQ's NPS Program uses a combination of tools including water quality standards development, surface and ground water monitoring, water quality assessment reports, Total Maximum Daily Load (TMDL) studies, TMDL implementation plans (TIPs), watershed inventories and characterizations, watershed-based plans, and Water Quality Improvement Grant (WQIG) projects to protect the state's water resources from nonpoint source pollution.


*Identifying and addressing water quality concerns are part of an ongoing cycle at ADEQ.*

NPS Program staff work closely with stakeholders to develop community-led, watershed-based planning efforts. These local planning efforts assist the department in developing Watershed Implementation Plans (WIPs) and other programs and outreach activities appropriate to the specific area and current issues. ADEQ's Web site provides a list of Arizona Watershed Partnerships (www.azdeq.gov/environ/water/watershed/partnerships.html). Within these watershed partnership structures, ADEQ and its partners are able to more easily identify, assess, and help implement voluntary efforts to control nonpoint source pollution.

Since Arizona has a large amount of publicly owned lands, partnerships with federal, state and tribal land and resource management agencies are key elements in the program's success. Arizona achieves these partnerships through a variety of formal and informal agreements, cooperative projects, sharing and combining of funds, and meetings to share information and ideas. Through these partnerships, Arizona works with a variety of entities to incorporate other appropriate water quality controls and further the goals of the Nonpoint Source Program.

Arizona's NPS Program has promoted and facilitated statewide efforts to manage the impact that nonpoint source pollution has on our surface and ground water. ADEQ continues to focus efforts on restoring waters that have been listed as impaired on the Arizona Integrated 305(b) Assessment and 303(d) Listing Report, as well as protecting waters that are attaining their designated uses. For detailed information about impaired water bodies please visit: http://www.azdeq.gov/environ/water/assessment/assess.html. Also see Appendix A of this document, titled "The Impaired Water Strategy."

ADEQ's NPS Program operates primarily under the direction of the NPS Management Plan. The current State Management Plan identifies nonpoint source goals and strategies for 2010-2014, and identifies four broad goals (identified below).

**Goals Identified in the 2010-2014 Arizona Nonpoint Source Five-Year Management Plan**

1. Prevent and reduce nonpoint source pollution discharges to protect surface or groundwater resources.
2. Coordinate efforts of various programs within ADEQ and with other agencies and partners to reduce nonpoint source pollution impacts to surface and groundwater.
3. Identify and mitigate impairments to surface water or groundwater quality.
4. Evaluate and improve the effectiveness of the nonpoint source pollution program and communicate success.

The NPS Program is also guided by EPA's "Measure "W". "Measure W" (also known as the Watershed Improvement Measure (WIM) and SP-12) is a key performance measure in EPA's Strategic Plan (http://www.epa.gov/ocfo/plan/plan.htm). The measure tracks watersheds where water quality conditions have improved by utilizing a watershed approach. One of the primary purposes of this measure is to model and demonstrate the effectiveness of the watershed approach. EPA has a nation-wide goal to improve water quality conditions in 250 watersheds for 2012. EPA Region 9 and our state water quality agency partners have agreed to track the following watersheds for purposes of reporting on this measure and documenting environmental results, and to better focus our water quality restoration activities by identifying needs, sharing information, providing assistance and learning more about the related challenges. ADEQ anticipates that all of these watersheds with the exception of Boulder Creek will show improvement by 2012 for the identified pollutant. ADEQ is currently coordinating with EPA and other partners to initiate project implementation on Boulder Creek during FY12. Additional watersheds may be added and/or substituted.

- Boulder Creek
- Alum Gulch
- Turkey Creek

- Tonto Creek
- Pinto Creek

## Arizona's Primary Nonpoint Source Pollutants

Nonpoint source (NPS) pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even groundwater.

Today, nonpoint source pollution remains the nation's largest source of water quality problems. It is the main reason that approximately 40 percent of our surveyed streams and lakes are not clean enough to meet basic uses such as fishing or swimming. The primary nonpoint source pollutants causing impairments in Arizona's most recent assessment (2006-2008) are:

- Suspended sediment
- Nutrients (low dissolved oxygen, high pH, nitrogen, or phosphorus)
- *E. coli* bacteria
- Metals and low pH
- Selenium
- Boron
- Historic pesticides

Some lakes and streams are listed for more than one of these pollutants. The 2006-2008 Status of Ambient Surface Water Quality in Arizona (Arizona's Integrated 305(b) and 303(d) Listing Report) indicates that Arizona has 7 lakes listed for 11 different pollutants and 47 stream reaches listed for 68 different pollutants. During the 2006-2008 assessment and listing cycle, EPA listed an additional 17 lakes for 23 pollutants and 16 stream reaches for 36 pollutants. Although in a few drainages point sources may be contributing, all of these impairments are primarily the result of nonpoint source contributions.

## Targeted Watersheds

Beginning in FY09 and continuing through FY11 and future fiscal years, the NPS Program has focused Water Quality Improvement Grant (WQIG) funding and technical support resources into formally identified Targeted Watersheds (Appendix B). These watersheds are listed below and, for ease of reference, have been grouped into three sets based on grant cycle. The progress that has been achieved to date in these watersheds will be detailed throughout this report.

**Cycle 11 Competitive Targeted Watersheds (State FY 09-10)**
Granite Creek (WQIG #11-T01)
Oak Creek (WQIG #11-T02)
San Francisco/Blue Rivers (WQIG #11-T03)

**Cycle 12 Competitive Targeted Watersheds (State FY 10-11)**
Little Colorado River Headwaters (WQIG #12-002)
San Pedro River (WQIG #12-003)
Tonto/Christopher Creeks (WQIG #12-007)

**Non-Competitive Targeted Watersheds (State FY11)**
Boulder Creek/Hillside Mine

All Targeted Watersheds are selected by ADEQ based on the presence of an NPS-related impairment as well as local stakeholder interest and ability to effectively address that impairment. Competitive Targeted Watersheds are awarded funding via a competitive grant cycle; Non-Competitive Targeted Watersheds are allocated funding based on ADEQ priorities and the potential to significantly address the primary NPS source of concern.

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# II. New Strategic Plan

The foundation of the 5-year Nonpoint Source Management Plan and subsequently this Annual Report is the strategic plan presented in this chapter. It contains specific goals, objectives, and strategies that ADEQ will implement to strengthen its Nonpoint Source Program.

The strategic plan describes how resources will be allocated to achieve the mission of Arizona's Nonpoint Source Program, which is to:

> *Achieve and maintain water quality standards through the reduction of nonpoint source pollutant contributions to Arizona's surface and groundwater.*

The components of ADEQ's strategic plan:

- **Goals** – Goals are like Generals. They look at the big picture. Goals show us what the world will look like after we achieve our objectives – the desired outcomes. Goals are broad and inclusive, yet attainable and realistic.
- **Objectives** – Objectives are like Sergeants, taking directions from the Generals (goals). They describe the broad changes needed to achieve a goal.
- **Strategies** – Strategies are the foot soldiers. Strategies are specific actions needed to accomplish an objective.
- **Milestones** – Milestones are steps, stages, or phases of implementing the strategy. They allow us to determine progress in accomplishing the strategies. They may include tactics – the tools that must be developed.
- **Responsible Parties** – These are the major players who are committed to implementing the strategy.
- **Measures of Success** – Indicators of success must be chosen for each strategy. These need to be quantifiable and directed at achieving the objective or goal.

Strategic planning starts with the end in mind by establishing broad goals and objectives. Four broad goals were established for this nonpoint source strategic plan:

**Goal #1:** Prevent and reduce nonpoint source pollution discharges to protect surface or groundwater resources.
**Goal #2:** Coordinate efforts of various programs within ADEQ and with other agencies and partners to reduce nonpoint source pollution impacts to surface and groundwater.
**Goal #3:** Identify and mitigate impairments to surface water or groundwater quality.
**Goal #4:** Evaluate and improve the effectiveness of the nonpoint source pollution program and communicate success.

Objectives and strategies are then selected to achieve each goal. Definable milestones, responsible parties, and measures of success are then developed for each strategy to direct implementation of the plan and to evaluate success. Measures of success will be monitored and results analyzed to document whether and how well desired outcomes were achieved. Analyses provide the information needed to direct strategic plan changes. Milestone percent completion estimates are based on the completion of the Milestones over the course of the five-year NPS period. Milestones for which work is consistent and ongoing over the five-year period are generally ascribed a completion percentage of 20% per year. Annual reports to EPA will use these milestones and measures of success to report on progress.

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*Goal #1: Prevent and reduce nonpoint source pollution discharges to protect surface or groundwater resources.*

**Objective 1.A - Invest in Water Quality Improvement and Education Grants (319(h) Grants) that are likely to provide long-term load reductions and changes in behavior and to achieve watershed-wide improvements in water quality.**

**Strategy 1.A.1**

**Grant proposals must demonstrate:**

- **How grant implementation will improve water quality on a watershed-scale basis**
- **That grantee has sufficient resources, technical skills, and commitments to implement and maintain the grant beyond the grant implementation cycle**
- **How the education component will encourage water quality improvements, long-term behavior changes, and encourage citizen involvement**

**Milestones**

- The grant manual revised to clarify grant requirements
- Grant process revised
- Technical assistance and training for grantees to improve grant proposals

**Success Indicators**

- Documented long-term grant project success after implementation of this objective
- More grant proposals fulfill this objective

**Responsible Parties**

- Grants and Outreach Program and grantees (e.g., NEMO, Master Watershed Stewards)

**Strategy 1.A.1. Progress Summary**

| Milestone | Progress | Responsible Party | Percent Complete |
|---|---|---|---|
| **1.** The grant manual revised to clarify grant requirements | The Grants & Outreach Unit focused resources on existing Targeted Watersheds during FY11, and did not release a revised grant manual. | **Grants & Outreach Unit** | **20 percent** |
| **2.** Grant process revised | In lieu of the standard competitive grant opportunity, funding was made available to existing Targeted Watersheds to support ongoing plan development and preliminary implementation projects. A total of $918,422.78 was awarded to continue planning and implementation efforts in the Granite Creek, Oak Creek, San Francisco/Blue River, and Coyote Creek (upper LCR Headwaters) watersheds. | **Grants & Outreach Unit** | **40 percent** |
| **3.** Technical assistance and training for grantees to improve grant proposals | Grants & Outreach Unit staff reviewed and provided feedback on draft requests for time extensions and additional funding for Targeted Watersheds on an as-requested basis. | **Grants & Outreach Unit** | **40 percent** |

**Objective 1.B – Encourage management practices that mitigate nonpoint source pollutant loadings.**

**Strategy 1.B.1**

**Develop a "BMP toolbox" of watershed remediation methods applicable to Arizona's hydrologic and geologic conditions and provide hands-on educational opportunities for target audiences in implementing these practices. Next 5-year focus: homeowner storm water management, recreation, grazing, septic systems, and shallow lake management.**

**Milestones**

- BMP toolbox available on Web site with user-friendly tools
- Training and education opportunities created where needed

**Indicators of success**

- Use of Web site and tools documented
- Demonstration sites visited
- New improvement projects associated with Web site use and demonstration site visits

**Responsible Parties**

- Grants and Outreach Program and grantees (e.g., NEMO, Master Watershed Stewards)
- TMDL Program

**Strategy 1.B.1 Progress Summary**

| Milestone | Progress | Responsible Party | Percent Complete |
|---|---|---|---|
| 1. BMP toolbox available on Web site with user-friendly tools | ADEQ contracted with the Arizona Nonpoint Source Education for Municipal Officials (NEMO) program to develop a web-accessible BMP manual. This manual was completed during FY11, and can be found online at http://nemo.srnr.arizona.edu/nemo/index_old.php?page=bmpmanual . Current WIP grantees have referenced this tool in the development of their preliminary planning documents. | **Grants & Outreach Unit** | **100 percent** |
| 2. Training and education opportunities created where needed | Not addressed during FY11 due to staff shortage. Additional staff was hired late FY11 to facilitate progress on this and other Grants & Outreach and TMDL related milestones. | **Grants & Outreach Unit, TMDL** | **0 percent** |

**Strategy 1.B.2**

**Complete state-wide watershed-based plans for use by local watershed partners that:**

- **Characterize the watershed**
- **Identify pollutants of concern**
- **Determine high-risk sub-watersheds for specific pollutants groups**
- **Include EPA's nine key elements for a watershed plan**

**Milestones**

- Plans completed for the last four watersheds: Colorado-Grand Canyon, Colorado-Lower Gila, San Juan (part of the Little Colorado), and the San Pedro.
- Education and training about these watershed-based plans for government leaders, resource managers, and other watershed partners
- Interactive Mapping Service available on line so interested watershed partners can work with GIS covers used to develop these plans.

**Indicators of success**

- Pollutant loading reductions in watershed because Information in plans used to:
  - Initiate new water quality improvement projects
  - Institute new land management decisions
  - Implement new BMPs

**Responsible Parties**

- Grants and Outreach Program and grantees (e.g., NEMO, Master Watershed Stewards)
- Watershed Partners

**Strategy 1.B.2 Progress Summary**

| Milestone | Progress | Responsible Party | Percent Complete |
|---|---|---|---|
| **1.** Plans completed for the last four watersheds: Colorado-Grand Canyon, Colorado-Lower Gila, San Juan (part of the Little Colorado), and the San Pedro. | Final plans for Arizona's ten 8-digit watersheds are completed and available on the AZ NEMO Web site at the following location: http://nemo.srnr.arizona.edu/nemo/index_old.php?page=characterization | **Grants & Outreach Unit** | **100 percent** |
| **2.** Education and training about these watershed-based plans for government leaders, resource managers, and other watershed partners | Not addressed during FY11 due to staff shortage. | **Grants & Outreach Unit** | **0 percent** |
| **3.** Interactive Mapping Service available on line so interested watershed partners can work with GIS covers used to develop these plans | The IMS is accessible on the AZ NEMO Web site (www.arizonanemo.org). AZ NEMO will continue to update GIS covers and provide training to WQIG targeted watersheds under their 2010-2012 contract with ADEQ. | **Grants & Outreach Unit** | **90 percent** |

**Objective 1.C – Encourage the use of legal authorities to reduce nonpoint source contributions to surface or groundwater, rather than relying on voluntary actions.**

**Strategy 1.C.1**

**Educate watershed partners about potential legal authorities to control nonpoint source loadings to surface or groundwater. Examples include, but are not limited to:**

- **Existing state and federal regulations (aquifer protection (A.A.C. R18-9), nitrogen management areas (A.A.C. R18-9), pesticide use and disposal (A.A.C. R18-6), hazardous waste use and disposal practices (A.A.C. R18-8), underground storage tanks (A.A.C R18-12), solid waste disposal regulations (A.A.C R18-13)**
- **Federal or state land use or permit restrictions (e.g., grazing permits, off-road vehicle use areas, road closures, MS4 permits)**
- **Local planning and zoning restrictions – existing and potential ordinances**

**Milestones**

- Education materials and training opportunities for watershed partners (e.g., authorities, process, where best used, and contact for info)

**Success Indicators**

- Watershed partners use legal authorities to reduce pollutants of concern.

**Responsible Parties**

- Aquifer Protection Permit Program
- Hazardous Waste Program
- Solid Waste Program
- Underground Storage Tanks Program
- Pesticide Program (Arizona Department of Agriculture)
- AZPDES Permits, including Storm Water Management
- Grants and Outreach Program and grantees (e.g., NEMO, Master Watershed Stewards)

**Strategy 1.C.1 Progress Summary**

| Milestone | Progress | Responsible Party | Percent Complete |
|---|---|---|---|
| **1.** Education materials and training opportunities for watershed partners (e.g., authorities, process, where best used, and contact for info) | Surface Water Section Manager Debra Daniel gave a presentation regarding the Clean Water Act and related Arizona rules and regulations to the Oak Creek Master Watershed Steward Class during FY11.<br><br>Grants & Outreach Staff began compiling information to develop educational materials regarding enforceable authorities in Arizona. | **Grants & Outreach Unit** | **20 percent** |

**Strategy 1.C.2**

**Identify methods for using land use management and written agreements to assure long-term load reductions for water quality improvement grants (319(h) Grants). For example, use of conservation easements, deed restrictions, Memorandums of Understanding.**

**Milestones:**

- Education materials and training for watershed partners
- Water Quality Improvement Grant agreement procedures modified to incorporate written agreements that better assure long-term load reductions.

**Success Indicators**

- Land management restrictions are used to assure load reductions.
- Grant project evaluations show that written agreements incorporated into grant process have assured project effectiveness well beyond the two year grant period.

**Responsible Parties**

- Grants and Outreach, including 319 grants (e.g., NEMO and Master Watershed Stewards)

**Strategy 1.C.2 Progress Summary**

| Milestone | Progress | Responsible Party | Percent Complete |
|---|---|---|---|
| **1.** Education materials and training for watershed partners | No activity during FY11 due to lack of resources. | **Grants & Outreach Unit** | **5 percent** |
| **2.** Water Quality Improvement Grant agreement procedures modified to incorporate written agreements that better assure long-term load reductions. | No activity during FY11; no new grant agreements were executed during FY11. | **Grants & Outreach Unit** | **0 percent** |

*Goal #2 Coordinate efforts of various programs within ADEQ and with agencies and partners to reduce nonpoint source pollution impacts to surface and groundwater.*

**Objective 2.A – Encourage public involvement and locally-driven efforts.**

**Strategy 2.A.1**

**Empower watershed partners to develop and implement watershed improvement and education projects by providing technical assistance, education, and training.**

**Milestones**

- Target education grants to provide needed technical assistance, education, and training for watershed partners
- Provide education and training opportunities on water quality topics of concern as requested by watershed partners, such as: sampling, credible data requirements, data tracking, field survey methods to identify pollutant sources and remediation projects, GIS mapping and modeling capabilities, grant writing

**Indicators of success**

- Increased knowledge results in more effective project implementation, higher load reductions, and more commitment to continue water quality improvements.
- Grant proposals submitted by watershed partners require less revision and less direct assistance from ADEQ staff to develop or implement.
- Monitoring data collected by watershed partners meet Credible Data requirements and can be used by ADEQ for assessments.
- Modeling, mapping, and GIS analyses available at Web site are used by local watershed partners to support water quality improvement project development.

**Responsible Parties**

- ADEQ Nonpoint Source Programs
- Grants and Outreach Program and grantees (e.g., NEMO, Master Watershed Stewards)

**Strategy 2.A.1. Progress Summary**

| Milestone | Progress | Responsible Party | Percent Complete |
|---|---|---|---|
| 2. Target education grants to provide needed technical assistance, education, and training for watershed partners | The WQIG program continues to support FY10-awarded education-based contracts. This includes:<br>• Two Watershed-scale Education and Training Grants (#12-002, #12-007) to provide nonpoint source impairment-specific education and training to watershed stakeholders<br>• Three contracts with the University of Arizona (EV11-0009, EV11-0010, EV11-0011) to fund AZ NEMO Program, Master Watershed Steward (MWS) Program, and Dr. Channah Rock to provide technical support and training services to ADEQ-identified targeted watersheds<br>• One additional contract (EV11-0008) with the U of A to fund Project WET Water Festivals, providing statewide youth education regarding water and water quality. | **Grants & Outreach Unit** | **40 percent** |

| | | | |
|---|---|---|---|
| 3. Provide education and training opportunities on water quality topics of concern as requested by watershed partners, such as: sampling, credible data requirements, data tracking, field survey methods to identify pollutant sources and remediation projects, GIS mapping and modeling capabilities, grant writing | Grants and Outreach and TMDL staff worked closely with watershed stakeholders throughout FY11 to provide watershed-specific education and training. Efforts were focused on Targeted Watersheds. ADEQ activities included in-the-field sampling and field survey trainings with the San Pedro, San Francisco, and Oak Creek watershed groups; as well as regular ADEQ data collection and interpretation updates for the Tonto/Christopher Creek group. In addition, the U of A NEMO program worked with targeted groups on GIS mapping, field survey methods, modeling, and data tracking techniques; MWS staff developed targeted watershed education courses and assisted in the development of presentations and educational materials; and Dr. Channah Rock worked extensively with the San Pedro, San Francisco, Granite Creek, Oak Creek, and Tonto Creek groups on *E. coli* sampling plan development and data interpretation methods. | **Grants & Outreach Unit** | **40 percent** |

**Objective 2.B – Encourage land and resource management agencies and tribal authorities to identify and mitigate nonpoint source pollution impacts in Arizona.**

**Strategy 2.B.1**

**Strengthen working relationships with other agencies and tribes to encourage development of effective water quality improvement projects and avoid projects or practices that would contribute to impairment of surface or groundwater quality.**

**Milestones**

- Memorandums of Understanding with other agencies and tribes updated to better support this 5-year strategic plan.
- ADEQ participation in coordinated resource planning efforts of federal and state agencies (e.g., planning, federal action reviews).
- Coordinate with other agencies to leverage funding opportunities, especially for priority projects within impaired watersheds (Objective 3.B.1).
- Tribal participation in watershed planning, educational opportunities, and priority water quality improvement project implementation.
- Meetings are held to determine and initiate new strategies to mitigate pollutant loadings

**Indicators of success**

- New strategies identified and implemented resulting in reduced pollutant loadings.
- Funds from multiple funding sources used to implement priority water quality improvement projects.
- More tribal representation in planning and watershed partner meetings.
- Tribal 319(h) grant proposals reflect a watershed approach to identify priority projects.

**Responsible Parties**

- ADEQ Nonpoint Source Programs
- Federal and state agencies who have signed MOUs with ADEQ
- ADEQ and EPA tribal liaisons
- Grants and Outreach Program and grantees (e.g., NEMO, Master Watershed Stewards)

| Strategy 2.B.1. Progress Summary | | | |
|---|---|---|---|
| **Milestone** | **Progress** | **Responsible Party** | **Percent Complete** |
| **1.** Memorandums of Understanding with other agencies and tribes updated to better support this 5-year strategic plan | No MOUs were completed or updated during FY11. A list of current MOUs has been developed, and ADEQ will continue to work with both new and existing partners to update and create MOUs that will allow the use of joint resources to address nonpoint source pollution throughout the state. ADEQ will focus future update efforts on MOUs with agencies in our targeted watersheds as they are identified. This includes the Bureau of Land Management, the Arizona State Lands Department (ASLD), and the Arizona Game & Fish Department.<br><br>Contact with ASLD was initiated during FY11 regarding MOU updates; a draft update based loosely on the recently updated USFS MOU is in preliminary stages. | **Grants & Outreach Unit** | **15 percent** |
| **2.** ADEQ participation in coordinated resource planning efforts of federal and state agencies (e.g., planning, federal action reviews) | The WQD provided comments on approximately 194 environmental reviews received from various federal, state, and local agencies.<br><br>The environmental reviews seek comments on potential environmental impacts from proposed projects, including sand and gravel operations leased on state lands, solar projects constructed on federal land, or rehabilitation projects using state funds. This process encourages the mitigation of nonpoint source impacts on water quality whenever a federal action is being considered. WQD also participated in federal and state agency planning efforts such as the Coordinated Resource Management and NRCS State Technical Meetings, and the Arizona Forest Stewardship Committee.<br><br>In addition, the TMDL Unit coordinates activities with USFS on-scene coordinator **regarding remedial activities on USFS lands. Discussions center upon current and ongoing USFS and ADEQ studies to see where resources can be combined to collect the necessary data to fulfill each agencies needs.**<br><br>**Throughout FY11, TMDL and Grants & Outreach Unit staff also coordinated with EPA Region 9, ASLD, and the Arizona Department of Administration Risk Management Division to develop a plan to address the mine tailings pile located on ASLD land at the former Hillside mine. Commitment of $600,000 in CWA Section 319 as well as $400,000 of non-federal (state) match was secured during FY11. WQD staff also coordinated with ADEQ Waste Management Staff to discuss on-site** | **Division-wide** | **40 percent** |

| | | | |
|---|---|---|---|
| | **construction management and contracting mechanisms once design work is completed. (*Continued)***<br>**Grants and Outreach staff continues to attend Coordinated Resource Management Meetings and NRCS State Technical Meetings to stay up-to-date on priorities of other state and federal agencies working in Arizona and to coordinate planning whenever possible.** | | |
| **3.** Coordinate with other agencies to leverage funding opportunities, especially for priority projects within impaired watersheds (Objective 3.B.1)<br><br>*Please see Appendix C for additional information regarding federal support for WQIG projects.* | WQIG projects awarded during FY11 had additional support in the form of funding and/or in-kind match from the following entities:<br>• Arizona State Land Department<br>• Arizona Game and Fish Department<br>• Arizona Department of Transportation<br>• Little Colorado River Resource Conservation and Development Area<br>• Gila County<br>• Franciscan Friars of California<br>• Private landowners/leasees | **Grants & Outreach Unit** | **40 percent** |
| **4.** Tribal participation in watershed planning, educational opportunities, and priority water quality improvement project implementation | No activity during FY11. | **Grants & Outreach Unit** | **20 percent** |

*Goal #3: Identify and eliminate impairments to surface water or groundwater quality.*

**Objective 3.A – Assess water quality of surface waters and groundwater.**

**Strategy 3.A.1**

**Perform state-wide surface and groundwater quality monitoring according to ADEQ's Monitoring Strategy (revised 2007) and analyze data to fulfill requirements of the Clean Water Act and state water statutes.**

**Milestones**

- State-wide surface water monitoring is completed in a three year cycle.
- Groundwater quality is characterized and reported for watershed partner use.
- ADEQ submits assessment report, assessment database, and list of impaired waters every two years to EPA.
- Impaired waters list and supporting GIS maps updated and available on internet

**Indicators of success**

- ADEQ continues to submit superior quality assessment and impaired waters identification reports that are approved by EPA.
- Groundwater basin reports complete at least one report per year.

**Responsible Parties**

- Ambient Monitoring Program
- Assessment Program

**Strategy 3.A.1. Progress Summary**

| Milestone | Progress | Responsible Party | Percent Complete |
|---|---|---|---|
| **1.** State-wide surface water monitoring is completed in a three year cycle | Monitoring has been completed for all three monitoring regions. | **Ambient Monitoring Program** | **40 percent** |
| **2.** Groundwater quality is characterized and reported for watershed partner use | Although field staff is limited to one employee, thirty-two groundwater sites were sampled during FY11 in the Ranegras Plain basin. Reports were also completed for three basins: McMullen Valley, Dripping Springs Wash and San Bernardino Valley. In addition, a draft report comprehensively examining groundwater quality in Arizona using the 1,500 samples collected from 1995-2009 by the ADEQ Ambient GW Monitoring program was completed. | **Ambient Monitoring Program** | **40 percent** |
| **3.** ADEQ submits assessment report, assessment database, and list of impaired waters every two years to EPA | The Draft 2010 Assessment Report is complete and under internal review. ADB updates are ready based on the draft assessment but have not yet been forwarded to EPA. | **Assessment Program** | **90 percent** |
| **4.** Impaired waters list and supporting GIS maps updated and available on internet | The draft 2010 303(d) list is complete and undergoing internal review. Discussions with EPA R9 regarding 2012 Assessment are ongoing. Maps have been created which depict the waterbodies assessed within each watershed. The list and maps will undergo a public comment period. | **Assessment Program** | **90 percent** |

**Strategy 3.A.2**

**<u>In-stream water quality sampling data submitted to ADEQ</u> to evaluate effectiveness of grants or treatment, ambient conditions, or impacts from potential pollutant sources:**

- **Is reliable, scientifically based, and meets credible data requirements established for listing impaired waters**
- **Is formatted so it can easily be loaded into ADEQ's database**
- **Includes supporting metadata needed to properly interpret the water quality data**
- **Is collected using protocols established by ADEQ, if applicable standards would require these protocols**

**Milestones**

- Current ADEQ's sampling methods and protocols are available over the internet
- Components of the Sampling Analyses Plans (SAPs) and Quality Assurance Plans (QAPs) required to meet credible data requirements are either provided in the permit or submitted to ADEQ with all in-stream surface water quality data
- The potential value of in-stream sampling requirements are considered for all AZPDES Permits, especially if the discharge might impact an impaired surface water
- Guidance documents establish credible data and submittal requirements, including supporting metadata requirements.

**Indicators of success**

- Monitoring data submitted to ADEQ meets credible data requirements, contains supporting metadata, and is easily loaded into ADEQ's database.

**Responsible Parties**

- Ambient Monitoring Program
- TMDL Program
- AZPDES Permit Programs
- Compliance and Enforcement
- Assessment Program
- Data Management Program
- Grants and Outreach Program and grantees (e.g., NEMO, Master Watershed Stewards)

**Strategy 3.A.2. Progress Summary**

| Milestone | Progress | Responsible Party | Percent Complete |
|---|---|---|---|
| **1.** Current ADEQ's sampling methods and protocols are available over the internet | Standard operating procedures were updated in 2010 and are available at http://www.azdeq.gov/environ/water/assessment/riverandstream.html<br><br>No update from TMDL in FY11 | **Ambient Monitoring Program, TMDL Program** | **100 percent** |
| **2.** Components of the Sampling Analyses Plans (SAPs),Quality Assurance Plans (QAPs), and Monitoring Plans required to meet | Permits Unit has developed improved permit language for those AZPDES permits which require ambient surface water quality monitoring in order to ensure the data collected will meet ADEQ credible data requirements. The Permits Unit is coordinating with the Ambient Monitoring and *(continued)* | **Grants & Outreach Unit, Permits** | **50 percent** |

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|---|---|---|---|
| credible data requirements are either provided in the permit or submitted to ADEQ with all in-stream surface water quality data | Assessment Programs to ensure appropriate guidance documents are available to permittees and referenced in the permits. | **Unit, Stormwater and General Permits Unit** | |
| **3.** The potential value of in-stream sampling requirements is considered for all AZPDES Permits, especially if the discharge might impact an impaired surface water | Boilerplate permit language has been revised to require permit writers to consider these issues when processing permit applications. Criteria are being developed to ensure in-stream monitoring requirements are incorporated into new and renewal permits when appropriate. | **Permits Unit** | **60 percent** |
| **4.** Guidance documents establish credible data and submittal requirements, including supporting metadata requirements | Most of the guidance document has been drafted; however there are still a few on-going modifications that will be included at a later time.<br>No additional work on this project was completed in FY11. | **Assessment Program** | **70 percent** |

**Strategy 3.A.3**

**Develop and implement <u>new tools, water quality standards, and sampling methods</u> to support water quality assessments and identification of impairments, sources, and key projects.**

**Milestones**

- Water quality standards developed or revised in accord with the Triennial Review Process.
- EPA's Environmental Monitoring and Assessment Program (EMAP) random monitoring approach is adapted for use in Arizona's arid environment.
- Arizona's Impaired Water Identification Rule is revised to incorporate new water quality standards and better reflect EPA's impaired waters listing guidance.
- New components are developed for Arizona's Assessment Calculator (AZAC) to provide computer assisted data analyses for water quality assessments.
- A data submittal process is established so that external data can be readily loaded into ADEQ's Water Quality Database.
- New methods developed to survey watersheds and to identify sources and key project sites that will significantly address impairments.
- Develop new databases to track field survey data and new methods to interpret field survey data.

**Indicators of success**

- Arizona assesses a higher percentage of perennial waters.
- Fewer surface waters must be added by EPA to Arizona's 303(d) List of impaired waters.
- Assessment reports are completed in a timely manner.
- New methods provide scientifically reliable evidence of source contributions
- New water quality improvement projects significantly reduce pollutant loading and lead to delisting of water quality impairments

**Responsible Parties**

- Ambient Monitoring Program
- TMDL Program
- Assessment Program
- Rule Development Program
- Data Management Program
- Grants and Outreach Program and grantees (e.g., NEMO, Master Watershed Stewards)

**Strategy 3.A.3. Progress Summary**

| Milestone | Progress | Responsible Party | Percent Complete |
|---|---|---|---|
| **1.** Water quality standards developed or revised in accord with the Triennial Review Process | The initiation of the formal rule making activities is on hold due to the moratorium on rule making. | **Assessment Program** | **40 percent** |
| **2.** EPA's Environmental Monitoring and Assessment Program (EMAP) random monitoring approach is adapted for use in Arizona's arid environment | The Ambient Monitoring Program has completed a random sampling approach for wadeable perennial streams in Arizona for 50 sites. A final report will be completed in 2012. | **Ambient Monitoring Program** | **90 percent** |
| **3.** Arizona's Impaired Water Identification Rule is revised to incorporate new water quality standards and better reflect EPA's impaired waters listing guidance | Arizona's Impaired Water Identification Rule established methods and criteria for identifying impaired waters and developing a Total Maximum Daily Load analysis. This rule was adopted in 2002.<br><br>No additional revisions were undertaken in FY11 and there is no timeframe for updating the rule as all agency rule making activities are on hold due to the moratorium on rule making. | **Assessment Program** | **40 percent** |
| **4.** New components are developed for Arizona's Assessment Calculator (AZAC) to provide computer assisted data analyses for water quality assessments | Initial work began to identify processes that could be improved/updated by ADEQ staff and which need to be contracted. Coordination with ADEQ staff is ongoing to develop a strategy. | **Assessment Program** | **15 percent** |
| **5**. A data submittal process is established so that external data can be readily loaded into ADEQ's Water Quality Database | Preliminary work was done to develop a data submittal process. Research is still being conducted in order to determine the best approach. | **Assessment Program** | **30 percent** |
| **6.** New methods developed to survey watersheds and to identify sources and key project sites that will significantly address impairments | Grants & Outreach and TMDL staff worked closely with the Cycle 11 and 12 Targeted Watersheds to develop and adapt watershed survey methods. | **TMDL Program, Grants & Outreach Unit** | **40 percent** |

| | | | |
|---|---|---|---|
| **7.** Develop new databases to track field survey data and new methods to interpret field survey data | Arizona NEMO continued database development for each of the three Cycle 11 Targeted Watersheds during FY11, and submitted a database template to ADEQ that will be adapted to meet the needs of each watershed. This template was designed to allow for easy transfer of data between the watershed groups and ADEQ. The Granite Creek Watershed group began actively utilizing their database during FY11. | **Grants & Outreach Unit** | **30 percent** |

**Objective 3.B - Target resources in watersheds with impaired waters to identify sources and implement plans to reduce pollutant loadings.**

**Strategy 3.B.1**

**Establish an <u>intra-agency team and an external partnership</u> for each impaired surface waters to help identify and implement new strategies to mitigate impairments.**

**Milestones**

- High priority impaired watersheds are identified for targeting resources such as 319(h) Grant resources, educational opportunities, and potential legal authorities.
- Two types of teams are created to identify resources and potential actions for high priority watersheds.
  - A multi-programmatic ADEQ team with a focus on legal authorities
  - A multi-agency team with watershed partners to identify and implement other strategies

**Indicators of success**

- New strategies are developed and implemented that result in water quality improvements

**Responsible Parties**

- Federal and State Agencies with MOUs
- ADEQ Permit Programs (AZPDES, APP, etc)
- Monitoring and Assessment Programs
- TMDL Program
- Grants and Outreach Program and grantees (e.g., NEMO, Master Watershed Stewards

**Strategy 3.B.1. Progress Summary**

| Milestone | Progress | Responsible Party | Percent Complete |
|---|---|---|---|
| **1.** High priority impaired watersheds are identified for targeting resources such as 319(h) Grant resources, educational opportunities, and potential legal authorities | Grants & Outreach and TMDL staff coordinated with ADEQ Waste Programs Division, EPA Region 9, Arizona State Land Department (ASLD), and the Arizona Department of Administration (ADOA) Risk Management Division to initiate an implementation plan and secure funding for projects at the Boulder Creek/Hillside Mine site. $600,000 in 319 funding and $400,000 in state match funding was secured. An additional $400,000 non-federal match is needed to secure an additional $600,000 that ADEQ has set aside. | **Grants & Outreach Unit** | **25 percent** |

| | | | |
|---|---|---|---|
| **2.** Two types of teams are created to identify resources and potential actions for high priority watersheds:<br>▪A multi-programmatic ADEQ team with a focus on legal authorities<br>▪A multi-agency team with watershed partners to identify and implement other strategies | ADEQ's internal team, consisting of TMDL and Grants & Outreach staff, continued to focus on project development at the Boulder Creek/Hillside Mine site. An external team consisting of EPA Region 9 Nonpoint Source and Superfund staff, ASLD, and ADOA was formed during FY11 (see above for additional details). No additional priority watersheds were identified during FY11 so that limited resources could be focused on the existing Targeted Watersheds. | **Grants & Outreach Unit** | **100 percent** |

**Strategy 3.B.2**

**Assist locally-driven efforts to develop and implement Watershed Improvement Plans (WIPs) in targeted watersheds that identify water quality improvement projects, education and training needs, and other actions needed to mitigate impairments.**

**Milestones**

- Watershed Improvement Council establishment and education
- Volunteers trained to conduct field surveys and water quality sampling
- Methods for field surveys and sample collection are developed, approved by ADEQ staff, and implemented
- Field surveys, sample collections, and other information are analyzed to identify key project sites
- Project sites are prioritized and best options for mitigating pollutant loading identified
- Planning documents are finalized
- 319(h) Grant fund used to implement plans, as appropriate

**Indicators of success**

- Watershed plans fulfill EPA's nine key elements for a watershed plan.
- Implementation is initiated through locally-driven efforts.
- Measurable improvements in water quality after implementation of projects.

**Responsible Parties**

- Federal and State Agencies with MOUs
- ADEQ Permit Programs (AZPDES, APP, etc)
- Monitoring Program
- TMDL Program
- Assessment Program
- Grants and Outreach Program and grantees (e.g., NEMO, Master Watershed Stewards)

**Strategy 3.B.2. Progress Summary**

| Milestone | Progress | Responsible Party | Percent Complete |
|---|---|---|---|
| **1.** Watershed Improvement Council establishment and education | In addition to the Watershed Improvement Councils (WICs) formed during FY10 for the Cycle 11 Targeted Watersheds, WICs were established in both of the Cycle 12 Targeted watersheds (San Pedro River and LCR Headwaters). | **Grants & Outreach Unit** | **40 percent** |

| | | | |
|---|---|---|---|
| **2.** Volunteers trained to conduct field surveys and water quality sampling | Volunteers have been trained in the Cycle 11 and Cycle 12 Targeted Watersheds.<br>FY11 training focused primarily on the San Pedro, Oak Creek, Granite Creek, and San Francisco River watersheds. | **Grants & Outreach Unit, TMDL Program** | **40 percent** |
| **3.** Methods for field surveys and sample collection are developed, approved by ADEQ staff, and implemented | Methods for field surveys and sample collection have been developed for the Cycle 11 and Cycle 12 Targeted Watersheds. Plans for the Cycle 11 watersheds were adapted during FY 11 to account for additional sampling that will take place through FY12. | **Grants & Outreach Unit, TMDL Program** | **40 percent** |
| **4.** Field surveys, sample collections, and other information are analyzed to identify key project sites | Analysis of field survey and sampling data continued in all three Cycle 11 Targeted Watersheds during FY11. Two of the Cycle 12 Targeted Watersheds (LCR Headwaters and San Pedro) initiated field surveys and sample collection as well. The TMDL Unit provided SAP and data review for all targeted watershed groups in FY 11 | **Grants & Outreach Unit, TMDL Program** | **40 percent** |
| **5.** Project sites are prioritized and best options for mitigating pollutant loading identified | The Granite Creek Targeted Watershed group made significant strides in identifying priority subwatersheds for further monitoring and implementation. Both the Oak Creek and San Francisco River groups completed first-phase monitoring and modeling to assist with site identification. | **Grants & Outreach Unit** | **20 percent** |
| **6.** Planning documents are finalized | Draft WIPs for the Granite Creek and San Francisco River Targeted Watersheds were submitted during FY11. The Oak Creek group began writing their draft WIP, with a planned submission in September 2011. Extensions were granted for all three Cycle 11 Targeted Watersheds to allow for additional sampling and WIP finalization. | **Grants & Outreach Unit** | **20 percent** |
| **7.** 319(h) Grant funds used to implement plans, as appropriate | While no WIPs have reached the implementation phase at this time, all monies awarded furthered implementation of approved WIPs (Appendix C). | **Grants & Outreach Unit** | **20 percent** |

**Strategy 3.B.3**

**Develop and implement TMDLs to identify source contributions and load reductions needed to meet standards.**

**Milestones**

- Scientifically-based TMDLs are developed according to the TMDL schedule.
- Status of TMDL development and existing TMDLs are available for stakeholders.
- Public involvement in TMDL Implementation Plan (TIP) development and implementation
- Nonpoint Source Grant funds used to implement TIP as appropriate

**Indicators of success**

- EPA approves ADEQ's TMDLs.
- TMDL implementation results in pollutant reductions

**Responsible Parties**

- Federal and State Agencies with MOUs
- ADEQ Permit Programs (AZPDES, APP, etc)
- Monitoring & Assessment Programs
- TMDL Program
- Grants and Outreach Program and grantees (e.g., NEMO, Master Watershed Stewards)

**Strategy 3.B.3 Progress Summary**

| Milestone | Progress | Responsible Party | Percent Complete |
|---|---|---|---|
| **1.** Scientifically-based TMDLs are developed according to the TMDL schedule | 11 TMDLs (**6 mercury impaired lakes in the Lake Mary Regional Mercury TMDL and 6 stream segments in the Oak and Spring Creek *E. coli* TMDLs)** were submitted to and approved by EPA R9 in FY11. | **TMDL Program** | **40 percent** |
| **2.** Status of TMDL development and existing TMDLs are available for stakeholders | The TMDL Web site is updated regularly and updates are provided when attending watershed group meetings. Completed and draft TMDLs (when in public notice) are available on the ADEQ website http://www.azdeq.gov/environ/water/assessment/download/status.pdf | **TMDL Program** | **40 percent** |
| **3.** Public involvement in TMDL Implementation Plan (TIP) development and implementation | The Lake Mary Regional TIP will be developed as a separate document. The Oak Creek TMDL includes a brief TIP but implementation will rely upon the WIP currently being developed by local stakeholders. | **TMDL Program** | **10 percent** |
| **4.** Nonpoint Source Grant funds used to implement TIP as appropriate | No activity during FY11. | **Grants & Outreach Unit** | **0 percent** |

| *Goal #4: Evaluate and improve the effectiveness of the Nonpoint Source Program and communicate success.* | | | |
|---|---|---|---|
| **Objective 4.A - Evaluate ADEQ's Water Quality Improvement Grants (319 Grants) and TMDLs to determine their effectiveness at creating long-term reductions in pollutant loadings.** | | | |
| **Strategy 4.A.1 Progress Summary** | | | |
| **Milestone** | **Progress** | **Responsible Party** | **Percent Complete** |
| **1.** ADEQ staff will evaluate effectiveness of education and on-the-ground improvement projects several years after the final project closeout | A framework for evaluating closed projects was developed during FY09. Staffing shortages prohibited site visits beyond those conducted for active and recently closed out projects during FY11. | **Grants & Outreach Unit** | **10 percent** |
| **2.** TMDL effectiveness is determined five years after completing the TMDL based on samples collected during critical conditions when past exceedances had occurred | ADEQ understands the importance of quantifying load reductions on a watershed, water body, and project level. However, quantifiable proof of NPS load reduction estimates is difficult to obtain. Effectiveness monitoring occurred on the Little Colorado River, Turkey Creek and the Verde River in FY11. | **TMDL Program** | **40 percent** |
| **3.** All grant projects have a monitoring component that measures water quality improvements and/or determines long-term behavioral changes | Grants and Outreach and TMDL staff continued to work with grantees throughout FY11 to write and adapt monitoring plans and provide monitoring resources, including training and equipment. | **Grants & Outreach Unit** | **40 percent** |
| **4.** Submit load reduction reports for nutrients and sediment reductions to EPA using their Grant Reporting and Tracking System | Load reduction estimates were entered into GRTS for six projects during State FY11. The load reductions associated with these projects totaled 34,453 lbs of nitrogen, 316 lbs of phosphorus, and 446 tons of sediment. FY11 marked the first year that ADEQ utilized the Automated Geopspatial Watershed (AGWA) tool to estimate load reductions. Please see Appendix E for additional information. | **Grants & Outreach Unit** | **40 percent** |
| **5.** Develop better methods for determining load reductions of all types of pollutants in arid conditions | ADEQ has contracted with AZ NEMO to calculate load reductions for WQIG projects that will reduce nitrogen, phosphorus, and/or sediment and will not be conducting monitoring sufficient to provide their own load reduction data. AZ NEMO will utilize the AGWA program to calculate load reduction data under their 2010-2012 contract. | **Grants & Outreach Unit** | **40 percent** |

**Objective 4.B – Communicate Nonpoint Source Program successes and lessons learned.**

**Strategy 4.B.1**

**Document "success stories" or "lessons learned."**

**Milestones**

- Grantees provide information and graphics in their final reports for these stories.
- Grant and TMDL effectiveness documented and communicated to the public.

**Indicators of success**

- Stories increased public awareness of these programs.
- Grant proposal methods reflect past successes and lessons learned.

**Responsible Parties**

- Grants and Outreach Program and grantees (e.g., NEMO, Master Watershed Stewards)
- TMDL Program

**Strategy 4.B.1 Progress Summary**

| Milestone | Progress | Responsible Party | Percent Complete |
|---|---|---|---|
| **1.** Grantees provide information and graphics in their final reports for these stories. | All final reports submitted to ADEQ during FY11 were in accordance with the final report format revised in FY09. This format follows the EPA 319(h) Success Story format to allow for smooth transition between final reports and success story submissions. The report format is available for download on ADEQ's Web site at http://www.azdeq.gov/environ/water/watershed/download/final.doc | **Grants & Outreach Unit** | **40 percent** |
| **2.** Grant and TMDL effectiveness documented and communicated to the public. | TMDL effectiveness data is shared with the watershed groups as it becomes available via emails and in-person updates. Summary statistics are made available to show improvements from TMDL to post implementation activities. | **Grants & Outreach Unit, TMDL Program** | **40 percent** |

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## Appendix A: The Impaired Water Strategy

ADEQ has a comprehensive strategy for improving water quality on Arizona's impaired waters that will lead to these waters meeting standards. The TMDL and WQIG programs bring together the resources needed to move the surface water through a series of steps or levels until the impairment has been mitigated and the stream or lake is meeting standards for the pollutants of concern. A spreadsheet was developed which tracks progress of each impaired lake or stream as it moves generally from Level A to F. The six (6) levels are:

- **Level A – Investigate and develop TMDL.**
  Most impaired waters start in Level A. The TMDL Program will develop further monitoring data to determine the extent of impairment (e.g., seasonality, area), likely sources, and develop a Total Maximum Daily Load (TMDL) that indicates the load and waste load reductions needed for the surface water to meet standards.
- **Level B – Develop a plan or other strategy that identifies and prioritizes effective water quality improvement projects.**
  This step is key to diminishing the pollutant sources and impacts and may be initiated even before a TMDL has been completed if there is adequate local support for development of a plan or if the land owner wishes to actively remediate the pollution. If the pollutant can be mitigated easily, a formal TMDL may not be necessary. Watershed Improvement Plans, TMDL Implementation Plans, or other formal strategies developed must include EPA's nine key elements of a watershed plan. These plans include a load or waste load reduction estimation, although not at the level of sophistication of a TMDL. If a TMDL has been completed first, the surface water automatically moves to Level B for development of the TMDL Implementation Plan (i.e., TIP). ADEQ works with watershed groups, other agencies, land owners, and other interested parties in Level B phase, bringing in expertise needed to identify and technically evaluate key projects.
- **Level C – Implement the plan or other strategy.**
  Level C - Surface waters move to Level C when the Watershed Improvement Plans, TMDL Implementation Plan, or other strategy is being implemented. Implementation may take years and require multiple phases.
- **Level D – Re-evaluate impairment due to watershed improvements, new standards, or natural conditions.**
  The impairment decision will be re-evaluated when water quality improvements are implemented, when relevant water quality standards change, or when preliminary data indicates that pollutants are solely due to natural conditions. New data are collected during this stage during critical conditions (conditions when exceedances have occurred in the past).
- **Level E – Request removal from Arizona's impaired water list.**
  If the data evaluation indicates that the surface water is no longer impaired by the pollutant(s) of concern, the surface water moves to this level for a short time. This level reflects the reality that surface waters must be officially removed from the impaired waters list, and this may take time.
- **Level F – Assign to EPA because ADEQ lacks jurisdiction (e.g. pollutant source are entirely in Mexico).**
  When all pollutant sources are outside of Arizona, particularly in Mexico, EPA will be notified and will be expected to take the lead in implementing pollutant mitigation actions. The spreadsheet shown in this appendix is a tool to coordinate efforts between several of ADEQ's programs and help focus efforts and funding opportunities with other federal, state, and local agencies. Improving water quality on *all* surface waters listed as impaired is a high priority for ADEQ, so the level does not infer a priority.

The following table is a slightly abridged version of the spreadsheet kept by ADEQ. The discharges under permit are not shown in this version due to space constraints.

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**Appendix A: Impaired Waters Table for FY10**

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| A | Alamo Lake | Mercury in fish (2002 by EPA) (ADEQ had it listed prior 2002) | Revised draft TMDL is under internal review. | Mining, air deposition. | Proposed: Identify, prioritize, and remediate mining sites in drainage, especially adjacent to streams and washes. | |
| A | Alamo Lake | Ammonia (2004)<br>pH (1996)<br>DO (2006) | Loss of resources has delayed the development of this TMDL. | Grazing, recreation. | Proposed: Identify and prioritize nutrient sources and implement appropriate BMPs. | Lake operated by Corps of Engineers. Monitoring by USFWS will provide data to support TMDL. |
| A | Alvord Park Lake | Ammonia (2004) | TMDL modeling is ongoing. | Urban, duck feeding, other. | Proposed: Identify and prioritize sources and implement appropriate BMPs.<br>*E. coli* impairments may be resolved due to the use of the wrong standard in the original listings. | City of Phoenix Parks Department |
| A | Apache Lake<br>Canyon Lake<br>Salt River just below Saguaro Lake | Dissolved oxygen (2004)<br>(Added Apache in draft 2006) | Loss of resources has delayed the development of this TMDL. | Wildfires, grazing, forestry, roads, small town urban sources. | Proposed: Identify and prioritize sources and implement appropriate BMPs.<br><br>WQIGs: Trees for the Rim (after wildfire) | USFS and Friends of the Forests |
| A | Bear Canyon Lake | pH (2004 by EPA) | Potential delist based upon recent data collection and timing of exceedances. | Unknown (recreation, grazing?). | Proposed: Identify and prioritize sources and implement appropriate BMPs. May de-list based on natural conditions. | US Forest Service MOU |
| A | Bill Williams River (from Alamo Lake to Castaneda Wash) | Ammonia (2006)<br>pH (2006),<br>DO (2006) | Loss of resources has delayed the development of this TMDL. | See source discussion for Alamo Lake nutrient impairments. | Proposed: Identify and prioritize nutrient sources and implement appropriate BMPs. | See discussion for Alamo Lake nutrient impairments |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| A | Chaparral Lake | DO (2004)<br>*E. coli* (2004)-<br>*E. coli* to be delisted in 2010 | TMDL modeling is Ongoing. | Urban lake. If connected to Indian Bend Wash, it receives urban drainage during storms from an area of Scottsdale. | Proposed: Identify and prioritize sources and<br>implement appropriate BMPs. | City of Scottsdale Parks Dept |
| A | Colorado River (from Hoover Dam to Lake Mohave) | Selenium (2004) | Preliminary literature review of selenium research along the Colorado River is underway. | Natural springs and out of state sources most likely. | Proposed: Identify and prioritize sources and implement appropriate BMPs. Identify source loads contributed from other states (how to remediate these?). Selenium from ag return flows is a point source, but these flows are exempt from permit requirements. | U.S. Fish and Wildlife Service |
| A | Colorado River (from Lake Powell to Paria River) | Selenium (2006)<br>Suspended sediment concentration (2004 by EPA) | Preliminary literature review of selenium research along the Colorado River is underway. | Same as Colorado reach above. | Proposed: Identify and prioritize sources and implement appropriate BMPs. Identify source loads contributed from other states (how to remediate these?). Selenium from ag return flows is a point source, but these flows are exempt from permit requirements. | National Park Service |
| A | Colorado River (from Main Canal to Mexico) | Selenium (2006)<br>DO (2006) | Preliminary literature review of selenium research along the Colorado River is underway. | Agriculture (crop production), WWTP discharges, septic systems, out-of-state loads. | Proposed: Identify and prioritize sources and implement appropriate BMPs. Identify source loads contributed from other states (how to remediate these?). Selenium from ag return flows is a point source, but these flows are exempt from permit requirements. | California's Colorado River Basin Board has also listed this portion of the river as impaired due to selenium. |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| A | Colorado River (from Parashant Canyon to Diamond Creek) | Selenium (2004)<br>Suspended sediment concentration (2004) | Preliminary literature review of selenium research along the Colorado River is underway. | Natural sandstone formations (SSC), natural springs (Se), grazing (SSC), recreation (SSC), out of state sources (Se). | Proposed: Identify and prioritize sources and implement appropriate BMPs. Identify source loads contributed from other states (how remediate these?). Selenium from ag return flows is a point source, but these flows are exempt from permit requirements.<br><br>WQIGs: 1. Kaibab Moccasin Wash range and crop BMPs (1997) 2. Fredonia riparian improvement 3. Milkweed riparian restoration (Hualapai) (2000) 4. Mohawk Canyon (Hualapai) 2005. Red springs fencing (Hualapai) 1998 6. Bank stabilization at Spencer Beach (2007) 7. Road Stabilization at Diamond Creek (2008) | Colorado River Salinity Program (B of R); Lower Colorado River Basin Compact (with other states) |
| A | Coors Lake | Mercury in fish (EPA listed in 2004) | No activities occurring on this project. | Mining impacts, Natural background | Proposed: Identify and prioritize mercury sources and implement appropriate remediation. | |
| A | Cortez Park Lake | DO (2004)<br>High pH (2004) | TMDL modeling is ongoing. | Urban lake, duck feeding. | Proposed: Identify and prioritize sources and implement appropriate BMPs. | City of Phoenix Parks Department |
| A | Crescent Lake | pH (2002 – EPA) | Sampling results indicate natural conditions may be causing the observed exceedances. Watershed affected by 2011 Wallow Fire. | Grazing. | Proposed: Identify and prioritize sources and implement appropriate BMPs. Possible de-list. | Friends of the Forest |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| A | East Verde River (from American Gulch to Verde River) | Arsenic (2006)<br>Boron (2006) | USGS collected samples with few exceedances measured to date. | Probably natural. Concentrations increase when water is not being transferred into this river from East Clear Creek. | Proposed: Identify and prioritize sources and implement appropriate BMPs.<br><br>Recent data shows no exceedances. | Verde Watershed Association |
| A | East Verde River (from Ellison Creek to American Gulch) | Selenium (2004) | Sampling is ongoing. No exceedances measured to date. | Unknown. May be Natural. | Proposed: Identify and prioritize sources and implement appropriate BMPs. | Verde Watershed Association |
| A | Gila River (from Centennial Wash to Gillespie Dam) | Boron (2004)<br>Selenium (2004) | Loss of resources has delayed the development of this TMDL. | Wastewater discharges, agricultural crop production including canal return flows, natural sources. | Proposed: Identify and prioritize sources and implement appropriate BMPs. Selenium from ag return flows is a point source, but these flows are exempt from permit requirements. | Corps of Engineers<br><br>Cities of Phoenix, Tolleson, Goodyear, and Avondale |
| A | Gila River (from Coyote Wash to Fortuna Wash) | Boron (2004 relist)<br>Selenium (2004) | Loss of resources has delayed the development of this TMDL. | Not yet identified. | Proposed: Identify and prioritize sources and implement appropriate BMPs. Selenium from ag return flows is a point source, but these flows are exempt from permit requirements. | |
| A | Gila River (from San Pedro R to Mineral Creek) | Sediment (2006) | Loss of resources has delayed the development of this TMDL. | Wildfires, grazing, forestry, roads, small town urban sources. | Proposed: Identify and prioritize sources and implement appropriate BMPs.<br><br>WQIGs: Trees for the Rim | |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| A | Little Colorado (from Porter Tank to McDonalds Wash) | Copper (1992)- delist<br>Silver (1992)- delist Suspended sediment concentration (2004 EPA, 2006 ADEQ) | Draft TMDL under internal review. | Unknown (metals), grazing, roads, recreation, other (SSC) | Proposed: Identify and prioritize sources and implement appropriate BMPs. | Little Colorado River Watershed Coordinating Council |
| A | Little Colorado (from Silver Creek Wash) | Sediment (EPA 2004)<br>*E. coli* (2004) | Draft TMDL under internal review. | Grazing, small urban areas. | Proposed: Identify and prioritize sources and implement appropriate BMPs.<br><br>WQIGs: Silver Creek sediment reduction (1994) | Silver Creek Advisory Commission and the Show Low Creek Partnership, Little Colorado River Watershed Coordinating Council) |
| A | Lyman Lake/ Reservoir | Mercury in fish (2004 by EPA) | Currently developing scope of work for modeling contractor | Air deposition. | Proposed: Identify and prioritize mercury sources and implement appropriate BMPs. | Little Colorado River Watershed Coordinating Council |
| A | Mule Gulch and tributaries, including Brewery headwaters to Highway 80 bridge (3 reaches) | Copper (1990)<br>Zinc (2004 portion)<br>Cadmium (2004 portion)<br>pH (2004 EPA portion) | Loss of resources has delayed the development of this TMDL and site-specific standard. | Current and historic Mining. | Proposed: Identify and prioritize sources and implement appropriate BMPs.<br><br>Completed: FMI has re-routed stormwater and seeps to minimize impacts to Mule Gulch<br><br>ADEQ is working on a site-specific copper standard | |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| A | Painted Rocks Borrow Pit Lake | DO (1992) | No recent activity on this project to report. | Urban, agriculture, grazing, roads, construction.<br>Prior diagnostic feasibility study indicated problem is primarily due to lake management and flow. | Proposed: (based on diagnostic feasibility study in 1990's) Operate lake in a manner that increases DO levels (e.g. higher levels).<br>Low priority--borrow pit only fills during flood events. | |
| A | Paria River (from Utah border to Colorado River) | Suspended sediment concentration (2004)<br>*E. coli* (2006) | Loss of resources has delayed the development of this TMDL. | Natural sandstone formations (SSC), natural springs (Se), grazing (SSC), recreation (SSC), out of state sources (Se and SSC).<br>Area may potentially provide data for natural background conditions. | Proposed: Identify and prioritize sources and implement appropriate BMPs. Identify source loads contributed from other states (how to remediate these?)<br>Exceedances possibly primarily due to natural conditions (sandstone) | National Parks Service MOU |
| A | Parker Canyon Lake | Mercury in fish (2004 by EPA) | TMDL development is ongoing. | Air deposition.<br>Investigating watershed to determine if any mining sources exist. | Proposed: Identify and prioritize sources and implement appropriate BMPs. | |
| A | Pinto Creek (from headwaters to Roosevelt Lake) | Copper (1990) | Adoption of site specific standard and TMDL are delayed due to rules moratorium. | Historic and current mining | TMDL indicated sources: 1. Mining, especially at Gibson Mine. 2. Survey area to identify other abandoned mining operations and prioritize for remediation.<br>WQIG: 1. Gibson Mine remediation (2006) 2. NPS Reduction of Copper to Pinto Creek (2011)<br>ADEQ is attempting to set a site specific copper standard | Friends of Pinto Creek |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| A | Pinto Creek (from unnamed tributary to Roosevelt Lake) | Selenium (2004) (expanded area in draft 2006) | Loss of resources has delayed the development of this TMDL. | Historic and current mining. | Proposed: Identify and prioritize sources and implement appropriate BMPs. | Friends of Pinto Creek |
| A | Queen Creek (from headwaters to Potts Canyon) | Copper (2002) | Contractor being hired to complete modeling effort. | Historic and current mining. | Proposed: Identify and prioritize sources and implement appropriate BMPs. | Arizona Parks Dept. friends of Boyce Thompson Arboretum. |
| A | Rose Canyon Lake | Low pH (2004 by EPA). | Low pH may be a natural condition. Data analysis is continuing. | Unknown. May be naturally low pH values. | Proposed: Identify, prioritize and implement appropriate nutrient BMPs. | |
| A | Salt River (from Pinal Creek to Roosevelt Dam) | Sediment (2006) | Loss of resources has delayed the development of this TMDL. | Grazing, forestry, roads, stream bank and channel destabilization, wildfires, mining. | Proposed: Identify and prioritize sources and implement appropriate BMPs.<br><br>May be de-listed in 2010 Assessment Report.<br><br>WQIG: Trees for the rim (wildfire) | USFS MOU<br>Friends of the Forest |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| A | Salt River below 23rd Ave WWTP<br>Gila River (from Salt River to Painted Rocks Reservoir) (8 reaches)<br>Hassayampa River (from Buckeye Canal to Gila River<br>Painted Rocks Reservoir<br>Painted Rock Borrow Pit Lake) | DDT, toxaphene, and chlordane in fish tissue (EPA listing 2002) (ADEQ had this listing from 1992 to 2002) | Loss of resources has delayed the development of this TMDL. | Historical use of pesticides in this area. Residual pesticides are likely being contributed from areas where the pesticides were sprayed historically. Some concern that banned pesticides may have been dumped or improperly buried. | Proposed: Identify and prioritize sources and implement appropriate BMPs. | |
| A | San Pedro River (from Aravaipa Creek to Gila River) | *E. coli* (2004)<br>Selenium (2004) | Draft *E. coli* TMDL is under internal review.<br><br>Additional sample is ongoing for selenium. Exceedances are seen under high flow conditions only. | Grazing, mining, stream bank and channel destabilization. | Proposed: Identify and prioritize sources and implement appropriate BMPs. WIP being developed for the middle San Pedro (2010) will likely be able to be used as a guide for identifying sources in this reach. ASARCO land swap taking place to mitigate loss of other riparian corridors may help. WQIGs: 1. Arivaipa Canyon riparian restoration (2000) 2. San Pedro riparian improvements (2000) 3. Wildlife habitat restoration (2003) 4. San Pedro cleanup trash (2003) 5. 3 Links Farm riparian restoration (2005) 6. Sediment control identification in The Narrows (2000) 7. Manzanita Erosion control (2006) | |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| A | Santa Maria River (from Little Sycamore Creek to Little Shipp Wash and from Bridle Creek to Date Creek) (2 reaches) | Mercury (2006) | Loss of resources has delayed the development of this TMDL. | Historic mining. | Proposed: Identify and prioritize mercury sources and implement appropriate remediation. | |
| A | Sonoita Creek (from 1600 feet below Patagonia WWTP discharge to Santa Cruz River) | Zinc (2004)<br>Low DO (1998) | No current activities on project. Zinc impairment appears to be related to Alum Gulch discharges. | Mining in the watershed or wastewater discharges. | Proposed: Identify and prioritize sources and implement appropriate BMPs.<br><br>WQIGs: 1. Audubon septic system improvements (2002) 2. Cattle exclosure at Audubon (2002) 3. C6 Ranch grazing BMPs (2002) 4. Redrock grazing improvements (2006) | Friends of Sonoita Creek and Friends of Santa Cruz |
| A | Virgin River (from Beaver Dam Wash to Bend Wash) | Selenium (2004)<br>Suspended sediment concentration (2004) | Loss of resources has delayed the development of this TMDL. | Natural sandstone formations (SSC), natural springs (Se), grazing (SSC), out of state sources (Se and SSC). | Proposed: Identify and prioritize sources and implement appropriate BMPs. Identify source loads contributed from other states (how to remediate these?).<br>ADEQ has very little data on this reach. | |
| B | French Gulch (from headwaters to Hassayampa River) | Copper (1994)<br>Zinc (1994)<br>Cadmium (1994) | Completed in 2004. | Mining (primarily Zonia Mine) | Identified in TMDL (still proposed): Remediate mining issues at Zonia Mine Identify, prioritize, and implement appropriate BMPs at other mines. | |
| B | Gila River (from Bonita Creek to Yuma Wash) | *E coli* (2004)<br>Suspended sediment concentration (2004 by EPA) | 30-day public notice period has been completed for both TMDLs. | Grazing, roads, mining, recreation. | Proposed: Identify and prioritize sources and implement appropriate BMPs.<br>Selenium from ag return flows is a point source, but these flows are exempt from permit requirements.<br><br>WQIGs: Gila River clean up (2006) | Upper Gila Watershed Partnership |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| B | Gila River (from New Mexico to Bitter Creek) | *E. coli* (draft 2006)<br>Suspended sediment concentration (2006) | 30-day public notice period has been completed for both TMDLs. | Grazing, agriculture crop production, septic systems. | Proposed: Identify and prioritize sources and implement appropriate BMPs.<br><br>WQIG: 1. Duncan Valley canal replacement (2007) 2. Gila Watershed Stewards Ph. I (2008) 3. Gila Watershed Stewards Ph. II (2010) | Upper Gila Watershed Partnership |
| B | Granite Creek (from headwaters Creek)<br>Watson Lake (on Granite Creek) Targeted Watershed FY2009) | DO (2004 - EPA –<br><br>Granite Creek)<br><br>Low DO (EPA 2004)<br>Nitrogen (EPA 2004)<br>High pH (EPA 2004) | Completing process to hire lake modeling contractor. | Urban, old city infrastructure, hobby farms, recycled wastewater, inadequate facilities for day workers, etc. | Proposed: Identify and prioritize sources and implement appropriate BMPs.<br><br>WQIGs: 1. Retention basin improvement and street sewer education program (2007) 2. Granite Creek channel re-contouring in Watson Woods 3. Granite Creek riparian improvement in Watson Woods 4. Granite Creek Watershed Improvement Plan (2009)<br><br>Other work completed by watershed group: ambient monitoring to determine sources of nutrients and *E. coli* bacteria. Other monitoring is proposed. | Prescott Creeks |
| B | Harshaw Creek (from headwaters to Sonoita Creek) | Copper (1988)<br>Low pH (1988) | TMDL completed in 2003. | Mine tailings. | TMDL sources identified: Remediate mining area by: removing or filling over mining residue; redirecting runoff away from mining deposits; removing mine wastes in the stream bed or combine with neutralizing materials; and constructing wetlands to treat mine discharges. | Friends of Sonoita Creek and Friends of Santa Cruz |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| B | Hassayampa River (from headwaters to Copper Creek, including tributaries such as Cash Mine Creek) | Cadmium (1992)<br>Copper (1992)<br>Zinc (1992)<br>Low pH (2006) | TMDL completed in 2002. | Mines in the upper Hassayampa River area, including but not limited to McCleur Mine, Senator Mine, Sheldon Mine, and Cash Mine. | Identified in TMDL and proposed: Remediate abandoned or inactive mine sites (McCleur Mine) contributing pollutants, including tailings and adits at these sites. | Prescott National Forest |
| B | Long Lake (lower) | Mercury in fish (2004 by EPA) | Included in Lake Mary Regional Mercury TMDL approved by EPA in 2011 | Air deposition. | Proposed: Identify and prioritize mercury sources and implement appropriate remediation. | Little Colorado River Watershed Coordinating Council |
| B | Luna Lake | High pH (1998)<br>DO (1998)<br>Narrative nutrients (1998) | TMDL completed in 2000, including TIP. | Grazing, septic systems, sporadic NPDES discharges, recycled nutrients in lake. | Proposed: Eliminate nutrient discharges from Alpine Sanitary District (no current project identified)<br><br>TMDL identified: Upgrade septic systems, grazing BMPs, urban BMPs, filter strips, riparian improvements, weed harvesting, dredging, and raise lake levels (reducing water diversions).<br>WQIG: Luna Lake septic system upgrades (2001) | Upper Gila Watershed Partnership |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| B | Oak Creek (from headwaters to Spring Creek – 5 reaches) Spring Creek (from headwaters to Oak Creek) Targeted Watershed FY2009 | *E. coli*(1994 – Slide Rock portion) (2006 draft - rest of Oak Creek and Spring Creek) | Revised TMDL approved in 2010. | Recreation, septic systems, urban runoff, grazing. | ADEQ is currently evaluating effectiveness of these projects to help direct future projects.<br><br>WQIGs: 1.Sediment traps - Guardian Project 2000. 2. Septic systems 2000-2002 3. Don't trash Slide Rock 4. Sediment catchments 00-02 5. Slide Rock education (1997) 6. DNA Genotyping (1999) 7. Septic systems (1998) 8. Outfall pipe (2000) 9. Septic survey (2001) 10. Trailhead toilets & riparian improvements (2002) 11. Redrock State Park constructed wetland (2006) 12. Oak Creek WQIG (2006) 13. Oak Creek Watershed Improvement Plan (2010) | Oak Creek Watershed ( |
| B | Peck's Lake | High pH (1998) Low DO (1998) | TMDL Completed in 2001, including TIP. | TMDL indicated sources primarily recycling of nutrients. Watershed is small and not currently developed. Shoreline communities have been proposed in the past, and would exacerbate pollutant loadings from developed areas. | TMDL sources identified: Improve riparian conditions to remove sediments that might add more nutrient loads.<br><br>Lake is on private (Freeport) land; ADEQ has no current samples. | Northern Arizona Audubon Society Verde Watershed Association |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| B | San Francisco (from Blue River to Limestone Gulch) and Blue River (from Strayhorse Creek to San Francisco River) (Targeted Watershed FY2009) | *E. coli* (2006) | Continued coordination with Targeted Watershed Group. Group continues to collect samples to determine sources of contamination. | Grazing, recreation, urban runoff, septic systems. Upper Gila Watershed Partnership and Greenlee County Health Department believes the problem is human recreation without proper facilities. | Riparian improvements, fencing, and alternative water sources for cattle have been funded piecemeal throughout the watershed. Proposed: Identify and prioritize sources and implement appropriate BMPs (being done under WIP--see #4 below).<br><br>WQIGs: 1. Martinez Ranch riparian Improvement and grazing BMPs 2. Kaler Ranch erosion control Phase I (2006) 3. Cole Creek and White Mule Creek sediment reduction (2004 4. San Francisco /Blue River WIP (2009) 5. Kaler Ranch erosion control Phase II (2010) | Upper Gila Watershed Partnership Greenlee County Health Department |
| B | San Pedro River (from Babocomari Creek to Dragoon Wash) Targeted Watershed FY2010 | *E. coli* (2004) | Initiated in 2006. TMDL currently on hold due to WQIG/ WIP development. | Grazing, septic systems, and urban runoff in Fairbank and Benson Area. | Proposed: Identify and prioritize sources and implement appropriate BMPs.<br><br>WQIGs: 1. San Pedro urban sediment reduction (Sierra Vista, 1995) 2. San Pedro sediment reduction (1997) 3. Borderlands upland improvements (2002) 4. Fort Huachuca road closure and crossing improve (2002) 5. San Pedro WIP (2010) | |
| B | Santa Cruz River (from Mexico to Nogales WWTP) | *E. coli* (2002) | Initiated in 2007. TMDL on hold due to loss of staff. | Grazing, unknown sources in Mexico. | Proposed: Identify and prioritize sources and implement appropriate BMPs. WQIG funds could be used to address grazing issues. .<br>EPA national Targeted Watershed in 2008; Sonoran Institute awarded $858,612 to identify pollutant sources, develop a plan of action, and implement education and on-the-ground strategies.<br>WQIGs: 1. Santa Fe Ranch riparian area improvement (2000) 2. Riparian improvement and monitoring (2003) 3. Santa Cruz River sediment control (2006) | Friends of Santa Cruz |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| B | Soldiers Lake and Soldiers Lake Annex | Mercury in fish (2004 by EPA) | Included in Lake Mary Regional Mercury TMDL approved by EPA in 2011. | Air deposition. | Proposed: Identify and prioritize mercury Sources and implement appropriate remediation. | Little Colorado River Watershed Coordinating Council |
| B | Three R Canyon (from headwaters Creek and tributaries (Cox Canyon) | Beryllium (1994)<br>Cadmium (1994)<br>Copper (1994)<br>Zinc (1994)<br>Low pH (1994) | TMDL completed in 2003. | Extensive mining in this small drainage, which includes unnamed tributary and Cox Gulch. | TMDL sources identified: Remediate mining area by: removing or filling over mining residue; redirecting runoff away from mining deposits; removing mine wastes in the stream bed or combine withneutralizing materials; and constructing wetlands to treat mine discharges. | Friends of Sonoita Creek and Friends of Santa Cruz |
| B | Tonto Creek (from headwaters tributary) and Christopher Creek (from headwaters to Tonto Creek Targeted Watershed FY2010 | *E. coli* (1998)<br>Phosphorus (relist 2006)<br>Low DO (EPA 2004)<br>Nitrogen (1998) | TMDLs for nitrogen and *E. coli* were completed in 2005. Effectiveness Monitoring continues. | Grazing, fish hatchery, inadequate septic systems for campgrounds and subdivisions. | TMDL identified sources: Inadequate septic tanks and recreational sources.<br><br>WQIGs: 1. Gila County septic system upgrades (2006) 2. R-Bar-C Boy Scout septic improvements (2007) 3. Tonto Baptist Camp septic upgrade (2008) 4. Tonto Watershed Improvement Grant (2010) | Tonto Watershed Improvement Group |
| B | Upper Lake Mary and Lower Lake Mary | Mercury in fish (2002 by EPA) | Included in Lake Mary Regional Mercury TMDL approved by EPA in 2011. | Primarily air Deposition. | Proposed: Identify and prioritize mercury sources and implement appropriate remediation. | US Forest Service MOU City of Flagstaff |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| C | Arivaca Lake | Mercury in fish (1992) | TMDL completed in 1999, included TIP. | TMDL identified primary sources as air deposition and natural deposition from local substrates. | TMDL sources identified: Manage lake to reduce production of methylmercury. Possibly dredge lake sediments | Friends of the Forest |
| C | Boulder Creek (from Butte Creek to Copper Creek) | Arsenic (before 1998) | Completed TMDL in 2004.<br>Completed TIP in 2005. | Mining. | See comment below. | |
| C | Boulder Creek (from Wilder Creek to Butte Creek) | Be, Mn, pH, As, Cu, Zn (before 1998) | Completed TMDL in 2004.<br>Completed TIP in 2005. | Mining. | TMDL identified sources: Remediation at Hillside Mine. Remediation plan is currently being developed by ADEQ, EPA R9, ASLD, and ADOA with tentative plans to implement spring 2012. | EPA Region 9<br><br>Arizona State Land Department<br><br>Arizona Department of Administration<br><br>Bureau of Land Management |
| C | Mineral Creek (from Devils Canyon to Gila River) | Selenium (2004)<br>Copper (1992)<br>Low DO (2006) | Consent decree requires mine to meet all surface water standards; therefore, TMDL has not been initiated. | Mining (Ray Mine and Gibson Mine). | ASARCO is looking at ways to mitigate selenium contamination and low dissolved oxygen occurring in mining tunnel constructed to direct surface water around mining operation. (Existing consent decree). ASARCO has mitigated manganese and the majority of copper pollutants WQIG - Gibson Mine Mineral Creek side – remediation at Gibson Mine may mitigate remaining Cu contamination here, because exceedances were only during heavy storm flows. | |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| C | Rainbow Lake | Narrative nutrient (weeds) (1992)<br>High pH (1992) | Completed TMDL and TIP in 2000. | Primarily nutrient recycling. BMPs have been implemented locally and the area around lake sewered to mitigate nutrients. May be grazing or urban runoff issues upstream. | Proposed: Identify and prioritize sources not identified in the TMDL and prioritize implementation. WQIG funds can't be used for in-lake treatments until all watershed contributions are addressed. ADEQ conducted preliminary monitoring to determine if dredging would be effective. Local community has decided to pursue alternative funds to apply herbicides or other in-lake treatments; it is unclear how this may impact assessment of the lake. Watershed group is moving forward with herbicide application (Fall 2010). Completed: Sewering of area. WQIGs: Rainbow Lake Water Quality Improvement Project (2008) –installed buffer strips around lake. | Little Colorado River Watershed Coordinating Council and Show Low Watershed Enhancement Partnership |
| D | Alum Gulch (from l to end of intermittent flow and tributaries (Humbolt Canyon) | Cadmium (1996)<br>Copper (1996)<br>Zinc (1996)<br>Low pH (1996) | TMDL completed in 2003. | Mine tailings and adit discharge. | TMDL sources identified: Remediate mining sources. USFS has remediated Worlds Fair and Humboldt Canyon mines. | Friends of Sonoita Creek and Friends of Santa Cruz |
| D | Cave Creek (from headwaters to South Fork of Cave Creek) | Selenium (2004) | Initiated in 2006. Recent results continue to show no exceedances. Watershed was burned in summer 2011. | Unknown. This is a pristine area. | | Upper Gila Watershed Partnership |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| D | Lakeside Lake | Nitrogen (2004 EPA)<br>Phosphorus (2004 EPA)<br>Chlorophyll (2004 EPA),<br>DO (2004)<br>NH3 (2004) | TMDL completed in 2005. | This lake formerly but no longer receives effluent. Wildlife, duck feeding, dog droppings may contribute some nutrients. | TMDL identified: Further treatment of effluent (tertiary or constructed wetland); provide more well water (not effluent); reduce storm water entering lake, dredge lake to remove nutrients in sediment; upgrade aeration system in lake; use alum to remove phosphorus from water column; use algaecides; and drop lake level in spring to minimize algae growth.<br><br>WQIGs: Treated lake with Alum to remove phosphorus; new permit indicates that city will not be discharging effluent to the lake | City of Tucson Park and Recreation. Arizona Game and Fish Department |
| D | Little Colorado River (from West Fork LCR to Lyman Lake) (several reaches) Targeted Watershed FY2010 | Sediment/turbidity (1992) | TMDL & TIP completed in 2002. Effectiveness monitoring was ongoing but the watershed was burned in the summer of 2011. | Grazing, recreation, silviculture (forestry), roads, smaller urban areas, stream bank and channel degradation. | Proposed: Identify and prioritize sources and implement appropriate BMPs.<br><br>WQIGs: 1. Coyote Creek sediment reduction (1998) 2. Big Ditch project (2000) 3. Coyote Creek Targeted Watershed Improvement Grant (2010) | US Forest Service MOU Little Colorado River Watershed Coordinating Council |
| D | Nutrioso Creek (from Nelson Reservoir to Little Colorado River) | Turbidity/sediment (1992) | Completed TMDL and TIP in 2002<br><br>Delisted upper portion (headwaters to Nelson Reservoir).<br><br>Watershed was burned in the summer of 2011. | Grazing, forestry, roads, stream bank and channel destabilization. | Proposed: Identify, prioritize, and implement sediment sources and implement appropriate BMPs<br><br>WQIGs: 1. EC Bar Ranch grazing projects (2000-2007), 2. Rogers Ranch improvements<br>(2000) 3. Murray-Saffel Canyon sediment controls (2001) 4. Greenwood sediment reduction (2003) | Little Colorado River Watershed Coordinating Council |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| D | Pena Blanca Lake | Mercury in fish | TMDL completed in 1999, included TIP. | Three sources identified in TMDL: 1) atmospheric deposition, 2) St. Patrick Mine ball mill site, 3) natural substrates. | TMDL identified: Remove tailings at St. Patrick Mine Ball Mill site and reduce sediment to lake. USFS has completed the remediation of St. Patrick mine. USFS dredged lake in 2009 to remove mercury recycling in lake sediments. Lake has been refilled and restocked, but it will take several years to determine fish tissue levels. | Friends of Santa Cruz |
| D | Stoneman Lake | Low DO (1998)<br>High pH (1998)<br>Narrative Nutrients | TMDL Completed in 2001, including TIP. | TMDL indicated sources primarily recycling of nutrients. Possibly related to septic systems. | TMDL sources identified: Septics. Increase water sources for lake.<br>Lake is ephemeral; low/fluctuating water levels make it difficult to meet standards.<br>Potential WQIGs: Replace septic systems, create grey water reuse systems, and construct sediment catchments. | Stoneman Lake Home Owners Association |
| D | Turkey Creek (from unnamed tributary to Poland Creek) | Copper (1992)<br>Lead (2004) | TMDL completed in 2007. Effectiveness monitoring is ongoing. | Historic mining. | US Forest Service has remediated tailings at Golden Belt and Golden Turkey mines. Doing effectiveness monitoring.<br>MSGP should address sources from Blue Bell mine. | USFS plans to remediate the mine site believed to be contributing the majority of pollutants. |
| D | Verde River (from unnamed tributary to Railroad Draw) (from Sycamore Creek to Beaver Cr) and (from HUC boundary to Fossil Creek) | Turbidity/sediment (1994) | Completed TMDL in 2002, including TIP. Recent data shows no exceedances of the SSC standard. Likely to be delisted in next assessment. | Grazing, urban development, roads, etc. | ADEQ will evaluate the success of existing water quality improvement projects to determine what further projects needed. WQIGs: 1.Verde Riparian Project riparian area improvements (1990) 2. Yavapai Ranch riparian improvements (1994) 3. Hickey Irrigation riparian area project (1996) 4. West Clear Creek riparian improvements (2001) 5. Upper Verde restoration (2002) 6. Upper Verde wildlife area (2006) 7. Hart Prairie sediment control (2006)<br>Recent data suggests potential for de-list due in part to WQIG-funded activities. | Verde Watershed Association |

| Mngmnt. Strategy | Surface Water | Pollutants (First Listed) | TMDL Development | Potential Sources | Improvement Activities/Comments | Support / Partnerships |
|---|---|---|---|---|---|---|
| E | Gila River (from Skully Creek to San Francisco River) | Selenium (2004) | Reach will be delisted in next assessment. | Crop production, grazing. | Proposed: Identify and prioritize sources and implement appropriate BMPs. Selenium from ag return flows is a point source, but these flows are exempt from permit requirements. | Upper Gila Watershed Partnership |
| E | San Pedro River (from Dragoon Wash to Tres Alamos Wash) | Nitrate (1990) | Site-specific Nitrate standard repealed in 2009. | Ongoing superfund site remediation at St. David (Apache Nitrogen Products). | Ongoing Superfund remediation and monitoring<br><br>WQIGs: San Pedro River cleanup near St. David (2003) | Community Watershed Alliance (Middle San Pedro) |
| F | Nogales and East Nogales Wash (from Mexico to Portrero Wash) | *E. coli* (1988)<br>Ammonia (2004)<br>Chlorine (1988)<br>Copper (2004) | Loss of resources has delayed the development of this TMDL. | Infrastructure deterioration in Mexico, which allows raw sewage to flow into Arizona. Chlorine is added to reduce human health risks. | Infrastructure upgrades must be accomplished in Mexico. | Friends of the Santa Cruz |

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## Appendix B: Targeted Watersheds Map

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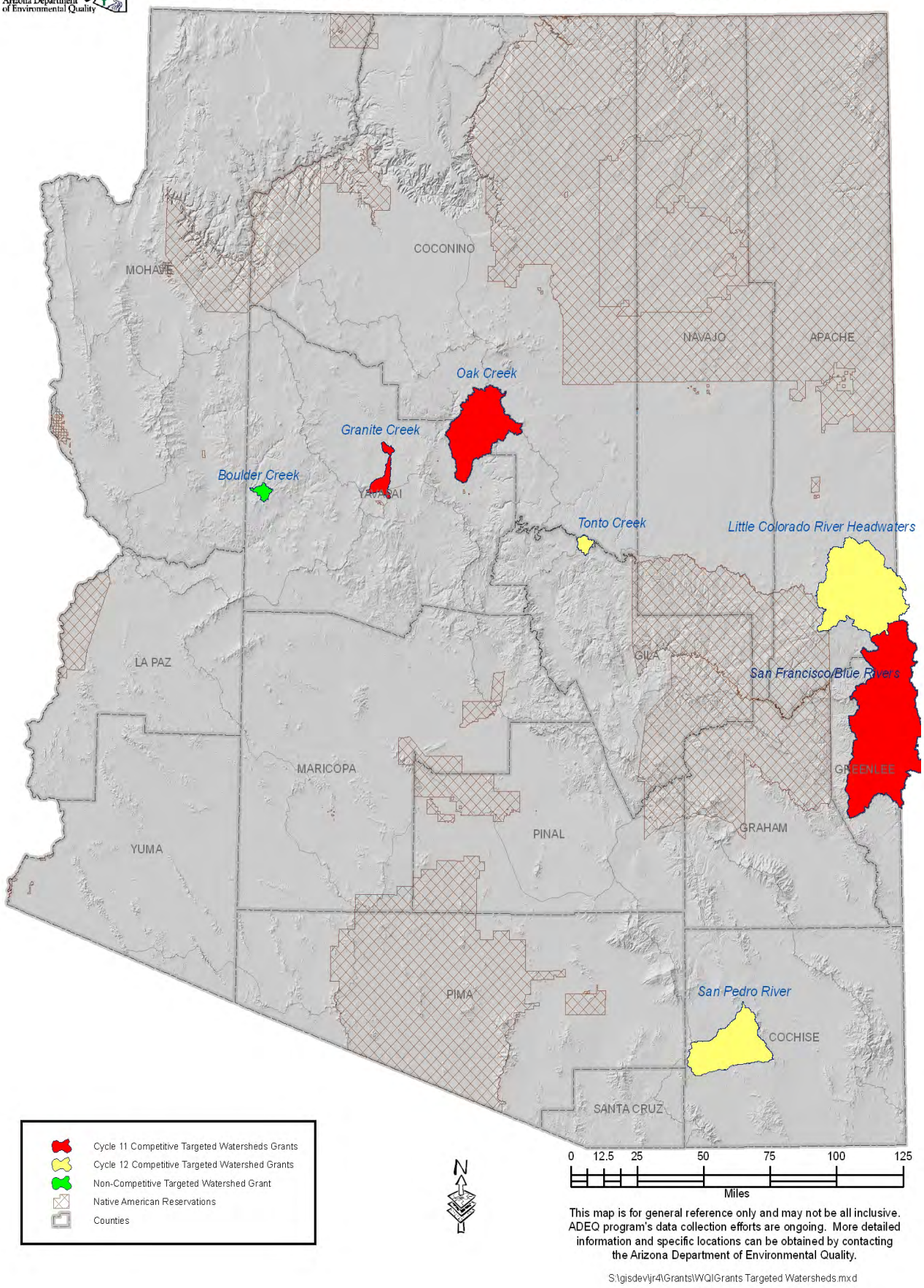
ADEQ Arizona Department of Environmental Quality

# Competitive and Non-Competitive Targeted Watershed Grants




This map is for general reference only and may not be all inclusive. ADEQ program's data collection efforts are ongoing. More detailed information and specific locations can be obtained by contacting the Arizona Department of Environmental Quality.

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## Appendix C: WQIG Projects Awarded During FY11

| State Project # (EPA Grant #) | Project Title | Authorizing Agency | Water Body | Impaired/ Pollutant of Concern | Purpose | TMDL/WBP Support | Award Amount |
|---|---|---|---|---|---|---|---|
| **EV09-0035** | | | | | | | |
| 11-T01 (98961308 M* 96973406 96998407 97959609) | Granite Creek Watershed Improvement Plan Grant (Extension)† | Prescott Creeks Preservation Association | Grantite Creek/Watson Lake | Yes/Nutrients, low DO, *E. coli* | A time extension and additional funding were awarded to allow the group to collect and analyze additional data necessary to make implementation recommendations and finalize the planning document. | ADEQ TMDL (draft) Draft WIP (2011) | *$220,539.24 (Total grant amount: $520,500.24)* |
| 11-T02 (96973406 M 96998407 98961308 97959609) | San Francisco/Blue Rivers Watershed Improvement Plan Grant (Extension)† | Upper Gila Watershed Partnership | San Francisco River/Blue River | Yes/*E. coli* | A time extension and additional funding were awarded to allow the group to collect and analyze additional data necessary to make implementation recommendations and finalize the planning document. | ADEQ TMDL (draft) | *$102,457.58 (Total grant amount: $290,894.18)* |
| 11-T03 (98961308 M 96973406 96998407 97959609) | Oak Creek Watershed Improvement Plan Grant (Extension)† | Oak Creek Canyon Watershed Improvement Group | Oak Creek | Yes/*E. coli* | A time extension and additional funding were awarded to allow the group to collect and analyze additional data necessary to make implementation recommendations and finalize the planning document. | ADEQ TMDL (1999, 2010) | *$224,942.36 (Total grant amount: $536,545.36)* |
| **EV10-0051** | | | | | | | |
| 12-002 (98961308 M 96973406 96998407) | Coyote Creek Watershed-scale Education and Training Grant† | Little Colorado RC&D | Coyote Creek/LCR Headwaters | Yes/Sediment | A time extension and additional funding were awarded to allow the group to move forward with BMP implementation. Originally awarded as an education grant with a planned Phase II for implementation, the grantee was able to achieve Phase I goals well ahead of schedule. | ADEQ TMDL (2002) | *$370,483.60 (Total grant amount: $494,087.60)* |
| 12-008 (98961310 M 97959609) | NPS Reduction of Copper to Pinto Creek †† | Franciscan Friars of California | Pinto Creek | Yes/Copper | Grant funds will be used to engineer and implement a soil cap at the abandoned Gibson Mine site, as well as to revegetate the area and engage nearby high school science programs to include information about nonpoint source and local mine mitigation activities in their curriculum. The cap will significantly reduce runoff of copper laden sediments from the abandoned mine site into Pinto Creek. | ADEQ TMDL (2001) | $701,470.00 |
| ** Indicates the EPA grant under which the Master file for the project is located in GRTS*<br>*† Indicates projects addressing one of ADEQ's Targeted Watersheds*<br>*†† Indicates projects located in a Measure W watershed* | | | | | | **Total Awarded: $1,619,892.78** | |

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## Appendix D: Open Nonpoint Source-Funded Projects

| | | | | 2002 | 2005 | 2006 | | 2007 | | 2008 | | 2009 | | 2010 | | 2011 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | C9-969984-07-0 | | C9-989613-08-0 | | C9-979596-09-0 | | C9-989613-10-0 | | | |
| | | | | NPS 13 | NPS 16 | NPS 17 | | NPS 18 | | NPS 19 | | NPS 20 | | NPS 21 | | NPS 22 | |
| | | | | | | | | $ 804,731.00 | $ 804,730.00 | $ 792,900.00 | $ 792,900.00 | $ 792,900.00 | $ 792,900.00 | $ 792,900.00 | $ 792,900.00 | $689,000.00 | $689,000.00 |
| | Total Award | Title | Project End Date | Inc | Inc. | Base | Inc. | Base | Inc. | Base | Inc. | Base | Inc. | Base | Inc. | Base | Inc. |
| 9-007 | $99,062.00 | Granite Creek Watershed - Water Quality Improvement Phase II | 3/31/2013 | | $55,064.93 | | $14,996.88 | | $15,907.83 | | $8,092.36 | | | | $5,000.00 | | |
| 9-008 | $483,191.00 | Watson Woods Riparian Preserve - Restoration Project Phase I | 3/31/2013 | $4,634.54 | $273,426.64 | | $45,531.00 | | $64,327.00 | | $60,616.78 | | $34,655.04 | | | | |
| 10-002 | $35,000.00 | Sediment Reduction into Diamond Creek and the Colorado River | 12/30/2011 | | | | | | | $35,000.00 | | | | | | | |
| 10-003 | $92,294.00 | Eagle Creek Watershed Restoration - Double Circles Ranch Phase III | 8/31/2011 | | | $57,755.64 | | $500.00 | | $34,038.36 | | | | | | | |
| 10-006 | $260,000.00 | Tonto Rim Christian Camp Water Quality Improvement Project | 6/30/2012 | | $134,978.93 | | $85,021.07 | | $40,000.00 | | | | | | | | |
| 10-007 | $251,400.00 | Sustainable Design for the Southwest Family Services Center Pervious Concrete Demonstration to Mitigate Storm water Pollution | 6/30/2012 | | | | | | | $233,198.60 | | $18,201.40 | | | | | |
| 11-004 | $74,145.00 | Wenima Wildlife Area Stream Restoration | 6/30/2012 | | | | $24,000.00 | | $500.00 | | $15,623.19 | | | | $34,021.81 | | |
| 11-005 | $25,164.00 | Water Quality Improvements for Francis Short Pond | 6/30/2011 | | | | | $1,488.00 | | $23,676.00 | | | | | | | |
| 11-006 | $211,825.00 | Middle Fossil Creek Water Quality Improvement Project | 9/30/2012 | | | | $25,999.83 | $12,276.59 | $30,000.00 | $6,403.01 | $86,295.36 | | $50,850.21 | | | | |
| 11-007 | $37,452.85 | Sediment Reduction from Runoff Using Best Management Practices | 7/31/2012 | | | | | | $10,000.00 | | $27,452.85 | | | | | | |
| 11-T01 | $520,500.24 | Granite Creek - Watson Lake Watershed Improvement Plan (EV09-0035) | 12/31/2012 | | | | $78,363.99 | | $87,162.48 | | $13,491.85 | | | | $200,000.00 | | $141,481.92 |
| 11-T02 | $290,894.18 | San Francisco - Blue River Watershed Improvement Plan Grant (EV09-0035) | 6/30/2012 | | | | $109,159.64 | | $42,873.98 | $29,978.60 | $17,367.09 | $91,514.87 | | | | | |
| 11-T03 | $536,545.36 | Oak Creek Targeted Watershed Improvement Plan (EV09-0035) | 12/31/2012 | | | | $32,144.65 | | $139,990.71 | | $80,000.00 | | $120,410.00 | | $164,000.00 | | |
| 12-001 | $550,000.00 | Septic Tank Closures for Program Year 9 of Lake Havasu City's Sewer Expansion Project Year 9 | 6/30/2012 | | | | $71,735.54 | | $70,114.00 | | $22,831.50 | | $385,318.96 | | | | |
| 12-002 | $494,087.60 | Coyote Creek Watershed-scale Education and Training Grant | 6/30/2012 | | | | $26,855.35 | | $83,823.77 | | $23,000.00 | | $23,946.69 | | $136,461.78 | | $200,000.01 |
| 12-003 | $265,551.00 | San Pedro River Watershed Implementation Plan | 6/30/2012 | | | | | | | | $88,759.63 | | $51,380.06 | | $125,411.31 | | |

## Appendix D: Open Nonpoint Source-Funded Projects

| | | | | 2002 | 2005 | 2006 | | 2007 | | 2008 | | 2009 | | 2010 | | 2011 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | C9-969984-07-0 | | C9-989613-08-0 | | C9-979596-09-0 | | C9-989613-10-0 | | | |
| | | | | NPS 13 | NPS 16 | NPS 17 | | NPS 18 | | NPS 19 | | NPS 20 | | NPS 21 | | NPS 22 | |
| | | | | | | | | $ 804,731.00 | $ 804,730.00 | $ 792,900.00 | $ 792,900.00 | $ 792,900.00 | $ 792,900.00 | $ 792,900.00 | $ 792,900.00 | $689,000.00 | $689,000.00 |
| | Total Award | Title | Project End Date | Inc | Inc. | Base | Inc. | Base | Inc. | Base | Inc. | Base | Inc. | Base | Inc. | Base | Inc. |
| **12-004** | $163,396.20 | Community Stewardship Model for Green Streets | 6/30/2012 | | | | | $5,355.36 | | $133,144.65 | | $24,896.19 | | | | | |
| **12-005** | $100,246.00 | E. Coli Reduction on the San Francisco River through Alternative Livestock Watering on Kaler Ranch, Phase II | 6/30/2012 | | | | $2,600.00 | | | | | $97,646.00 | | | | | |
| **12-006** | $44,200.00 | The Upper Gila Watershed Steward Project | 6/30/2012 | | | | | | $9,132.37 | | | | | | $35,067.63 | | |
| **12-007** | $70,791.33 | Tonto Watershed Improvement Group Watershed Education and Training Grant | 6/30/2012 | | | | | | | | | | | | | $70,791.33 | |
| **12-008** | $701,470.00 | NPS Reduction of Copper to Pinto Creek | 6/30/2013 | | | | | | | | $38,138.20 | $279,826.54 | | $383,505.26 | | | |
| **EV11-0008** | $29,261.87 | Arizona Water Festivals - Building on an Effective Education Model | 9/30/2012 | | | | | | | $29,261.87 | | | | | | | |
| **EV11-0009** | $334,183.00 | Arizona NEMO Nonpoint Source Education for Municipal Officials | 6/30/2012 | | | | $30,979.24 | | $50,000.00 | | $151,312.91 | | $60,000.00 | | $41,890.85 | | |
| **EV11-0010** | $210,588.00 | Arizona Master Watershed Stewards (MWS) Educational Outreach and Technical Support Program Continuation (2010-2012) | 6/30/2012 | | | | $24,000.00 | | $15,141.48 | | $75,000.00 | | $40,400.00 | | $56,046.52 | | |
| **EV11-0011** | $59,482.00 | Arizona NEMO - Training and Analytical Support Program 2010-2012 | 6/30/2012 | | | | $12,776.37 | | | | $38,978.38 | | $7,727.25 | | | | |
| **EV12-0005** | $250,000.00 | DEMA Wallow Fire Mitigation Funding | 6/30/2013 | | | | | | | | | $250,000.00 | | | | | |

## Appendix E: WQIG Load Reduction Calculations for Nitrogen, Phosphorus, and Sediment as Tracked in the EPA Grant Reporting and Tracking Database (GRTS)

Each project funded by the WQIG program to implement an on-the-ground water quality improvement project must describe a process for evaluating the effectiveness of the implementation efforts over time. Monitoring can include photographic tracking of project progress, vegetative transect data, and/or actual water quality monitoring data. Information on reductions in nitrogen, phosphorus, and sediment nonpoint source loads are tracked and reported in EPA's Grant Reporting and Tracking database (GRTS). GRTS enables EPA and states to demonstrate the accomplishments achieved with the use of 319(h) funding. The data entered into GRTS is used by the EPA to respond to inquiries received from Congressional committees, the White House, and various constituent groups.

FY11 marks the first year that ADEQ utilized the Automated Geospatial Watershed Assessment (AGWA) Tool to estimate pollutant load reductions from projects that did not conduct pre- and post-implementation water quality monitoring. AGWA uses widely available standardized spatial datasets to develop input parameter files for two watershed runoff and erosion models: KINEROS2 and SWAT. ADEQ chose to utilize AGWA primarily because it can be calibrated to reflect characteristics unique to arid areas. This is a capability that is not well supported by common GRTS load reduction tools such as the EPA Region 5 and STEP-L models. ADEQ anticipates that the use of AGWA will result in realistic, scientifically defensible load reduction estimates when "real-world" data is not readily available for completed projects.

Arizona's FY11 load reductions were determined based on a combination of AGWA estimates and grantee-provided data:

| | | | EPA Federal FY 10 Reductions | | |
|---|---|---|---|---|---|
| | | | Nitrogen | Phosphorus | Sedimentation-Siltation |
| EPA Grant Number | State Project Number | Project Title | LBS/YR | LBS/YR | TONS/YR |
| 96998407 | 10-005 | White Mountain Apache Tribe Water Quality Improvement | 5,696 | 315 | 394 |
| | 10 E-010 | Creating a Neighborhood Model to Address Urban Stormwater Pollutants | 0.1 | 0.0157 | 0.0025 |
| | 10 E-013 | Gila Valley Best Management Practices on Crop Land | | | 52 |
| 97959609 | 12-001 | Septic Tank Closures for Program Year 9 of Lake Havasu City's Sewer Expansion Project Year 9 | 2,832 | | |
| 98961308 | 11-006 | Middle Fossil Creek Water Quality Improvement Project | 5 | 0.0858 | |
| | 11-001 | Septic Tank Closures from Program Year 8 of Lake Havasu City's Sewer Expansion Program | 25,920 | | |
| | | **Totals:** | **34,453** | **316** | **446** |

Below is an example load reduction report, prepared by the Arizona NEMO Program at the University of Arizona based on results from the AGWA Tool:

Modeling Results- WQIG #10-005

Arizona Department of Environmental Quality
Water Quality Improvement Grant Program
White Mountain Apache Tribe's Water Quality Improvement Program
Grant Application 10-005

Modeling Tool:
Automated Geospatial Watershed Assessment (AGWA), Soil and Water Assessment Tool (SWAT)

Data Sources:
30m Digital Elevation Model (DEM) acquired from USGS at http://seamless.usgs.gov
30m land cover data acquired from Southwest Regional GAP (SWReGAP) at http://earth.gis.usu.edu/swgap/mapserver/
Soils data acquired from Natural Resources Conservation Service (NRCS) at http://soildatamart.nrcs.usda.gov/usdgsm.aspx
Precipitation data acquired from National Climatic Data Center (NCDC) at http://www.ncdc.noaa.gov/oa/ncdc.html

The purpose of the project is to mitigate the damages caused by the Rodeo-Chediski Fire of 2002. Restoration efforts have been implemented to reduce soil loss from erosion, stream channel degradation, and overland flow. Re-establishment of riparian buffer zones, runoff detention ponds, and reforestation programs help accomplish these goals. Exclusionary fencing also restricts ungulate grazing and enhances restoration of riparian zones. The Soil and Water Assessment Tool (SWAT) was used to model changes in sediment and nutrient runoff as a result of recuperation of vegetative cover.

Modeling was first performed using recent land cover data in order to establish current rates of sediment and nutrient yields. The model was then run again with changes made to the land cover in the burned areas to reflect damages caused by the fire. The differences in sediment and nutrient runoff were dramatic, and they are as follows:

Sediment Yield – 480.3 tons/year
Organic Nitrogen – 5695.8 lbs/year
Organic Phosphorous – 315.4 lbs/year

It should be noted that these numbers reflect the difference between newly burned land cover and current land cover, and it can be assumed that recuperation of vegetative ground cover is a slow process.

AGWA Fact Sheet

*Available online at http://www.tucson.ars.ag.gov/agwa/index.php/publications-mainmenu-28*

U.S. Environmental Protection Agency

EPA/600/C-07/015
ARS/218468

# AGWA - Automated Geospatial Watershed Assessment

## What is AGWA?

The Automated Geospatial Watershed Assessment (AGWA) tool is an interface designed to run two watershed runoff and erosion models: the Kinematic Runoff and Erosion (KINEROS) model, and the Soil and Water Assessment Tool (SWAT). The interface was developed in a geographic information system (GIS) to facilitate the preparation of model inputs, and the visualization of model outputs.

## How can AGWA help with TMDLs?

- Locating potential impairment
  - AGWA can quickly and inexpensively identify and prioritize problem areas at the basin and watershed scales
- Evaluating the impacts of land-use change
  - AGWA can evaluate where water-quality impacts of past and future landscape change are most significant
  - AGWA includes a land-cover modification tool to assist with scenario development
- Mapping results
  - All model outputs for both streams and upland areas can be mapped to facilitate comparisons with other data layers and the presentation of results

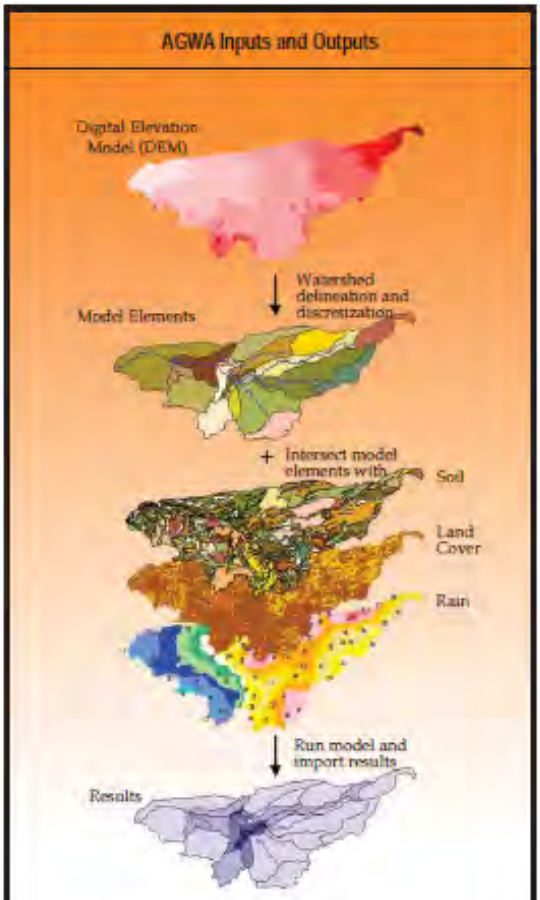
## Where can I get AGWA?

AGWA example datasets, training exercises, and documentation can be downloaded via the Internet free of charge from:

www.tucson.ars.ag.gov/agwa
*or*
www.epa.gov/nerlesd1/land-sci/agwa

## What's Next?

- DotAGWA – a web-based interface for AGWA is currently under development. The interface will allow users to access all of the same functionality of AGWA without purchasing expensive GIS software, or downloading and projecting data. DotAGWA will




Output results that can be displayed in AGWA

| KINEROS Outputs | SWAT Outputs |
|---|---|
| Channel infiltration ($m^3$/km) | Precipitation (mm) |
| Plane infiltration (mm) | ET (mm) |
| Runoff (mm or $m^3$) | Percolation (mm) |
| Sediment yield (kg) | Surface runoff (mm) |
| Peak flow ($m^3$/s or mm/hr) | Transmission loss (mm) |
| Channel scour (mm) | Water yield (mm) |
| Sediment discharge (kg/s) | Sediment yield (t/ha) |

# AGWA - Automated Geospatial Watershed Assessment

also allow users to develop land-use management scenarios, and simulate their impacts on water and sediment yields.

## System Requirements

AGWA 2.0 requires ArcGIS 9.x, Spatial Analyst 9.x, and the .Net Framework. AGWA works with Windows 95, 98, 2000, NT, ME, XP, and Vista operating systems.

## For Further Information

*For further information contact:*

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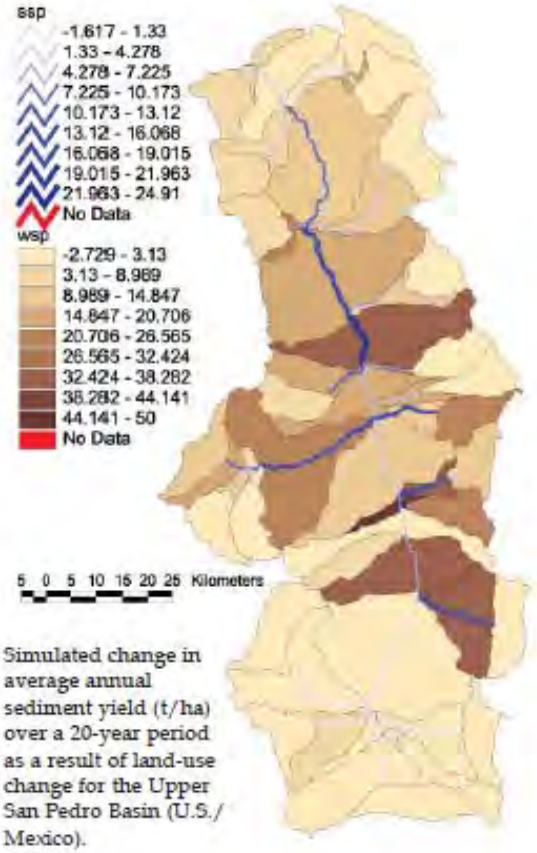



Simulated change in average annual sediment yield (t/ha) over a 20-year period as a result of land-use change for the Upper San Pedro Basin (U.S./ Mexico).

## Appendix F: Success Stories

Two Water Quality Improvement Projects have proven successful for inclusion into this year's Annual Report. The first success story involves a well coordinated and able-bodied ranching community in Southeastern Arizona; the second a close knit grass roots community in Prescott, Arizona.

ADEQ project 8-007: Upper Eagle Creek Watershed Improvement Project, described below recently closed. The ranching community and ADEQ are anticipating continued load reduction to Eagle Creek and tributaries long into the future because of their long term dedication to maintaining the BMPs. The subsequent success story, ADEQ project 11-T02: Upper Granite Creek Watershed Improvement Plan is an active project. We are anticipating load reduction results in the near future.

### 1. Completed Project Success Story: ADEQ Grant 8-007/ Upper Eagle Creek Watershed Improvement

**Submitted by: Linda Searle, Coronado RC&D**

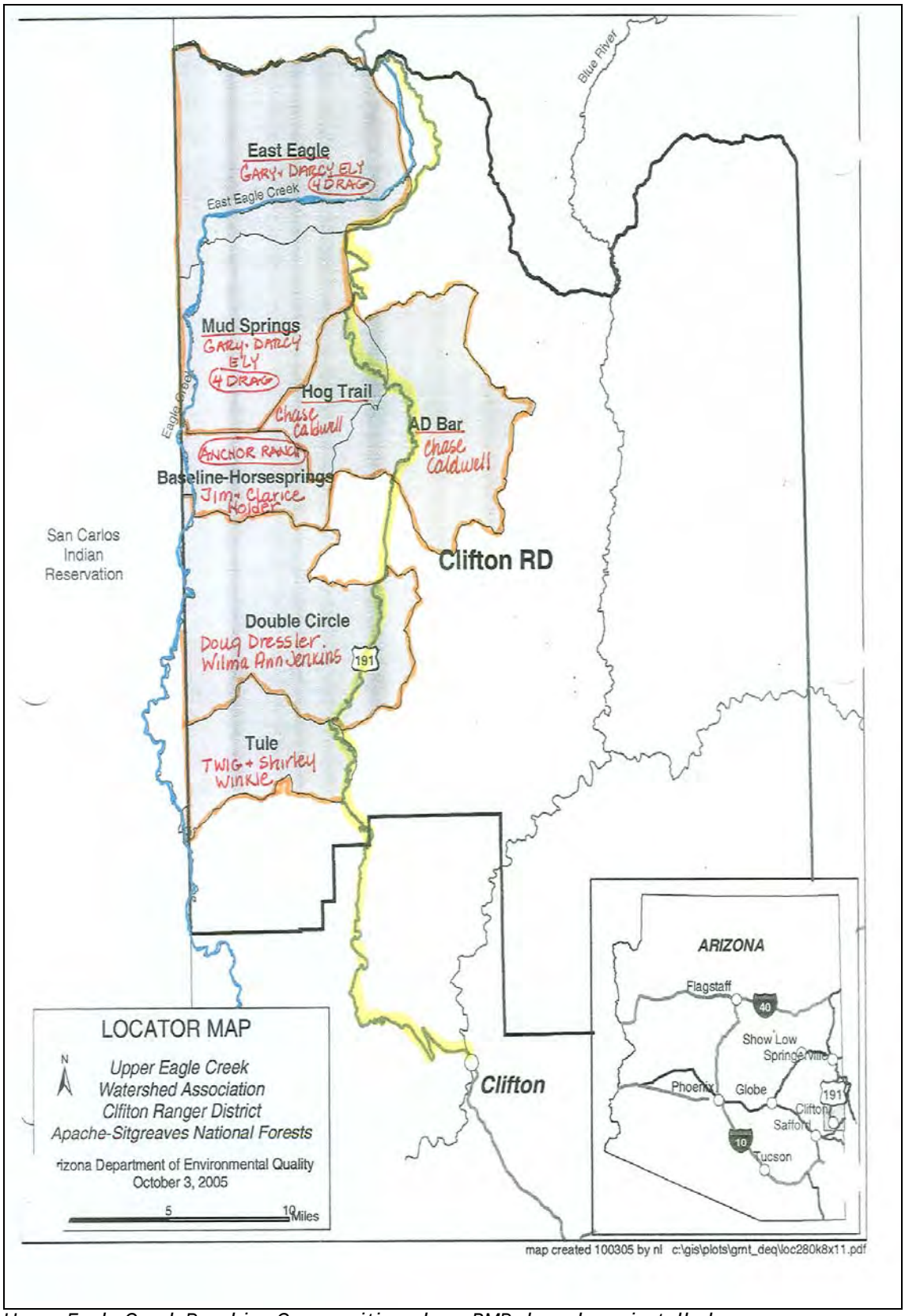
#### Waterbody Improved

(1) The goal of this project was to improve water quality by reducing the impact of sediment in a reach of **Upper Eagle Creek** in northern Greenlee County. Upper Eagle Creek is a tributary to the Gila River and lies largely on US Forest Service land allotted for grazing.

(2) Pre-existing riparian exclusion fencing along several stream reaches in the Upper and Lower Eagle Creek sub-watersheds were destroyed by the floods of January 2005. Some existing pipelines to alternate water sites were in disrepair and unreliable, leaving livestock to congregate in actual spring areas instead of dispersing through the pasture. Resultant utilization of riparian vegetation plus the direct impact of manure and urine in the creek and springs presented potential degradation of the water quality and damage to critical habitat for a variety of wetland and aquatic species. Trampling by livestock also contributed to stream bank erosion. This project provided implementation of a variety of best management practices, including the construction and repair of riparian fence exclosures, alternative water sources using black poly pipe mated to fiberglass storage tanks and/or troughs, solar power systems, and /or earthen tanks, rotational grazing and grass banking were utilized to allow for rest and deferment of selected pastures and to protect and improve water quality in the Upper and Lower Eagle Creek sub-watersheds of southeastern Arizona. This project has helped to protect and enhance water quality through the improved grazing management approach.

#### Issue Addressed

Eagle Creek, extending from the Mogollon Rim to the Gila River, is perennial for about 64 miles. Eagle Creek is the predominant perennial water in these several sub-watersheds, and about 50% of its perennial length is within the boundaries of the Apache-Sitgreaves National Forests. Of that length, over 8 miles of stream corridor flows through private lands, a significant portion of which is owned by members of the Upper Eagle Creek Watershed Association (UECWA), or is under a Memorandum of Understanding with the U.S. Forest Service and the UECWA for riparian restoration (Gust MOU, 2005).




*Upper Eagle Creek Ranching Communities where BMPs have been installed.*

Eagle Creek is fed by a myriad of networks of tributary drainages, over 89 miles of which are encompassed within allotments to members of the UECWA, managed by the Clifton Ranger District. These drainages encompass over 12 miles of additional perennial and intermittent riparian and wetland systems, and numerous springs. Combined, these water sources offer designated and nominated critical habitat for a variety of federally and state listed species, including native fish such as Loach minnow, Spikedace, and Gila chub; a host of amphibians including Chiricahua leopard frog and other native frog species; reptiles like the Narrow-headed garter snake; indigenous raptors such as the Mexican spotted owl, Northern goshawk and Common Blackhawk; and riparian-obligate birds such as the Yellow-billed cuckoo and Yellow breasted Chat. The area is also habitat for experimental release of Mexican gray wolf.

While Eagle Creek is not listed as an impaired reach on the state's 303(d) list, it does flow into the Gila River, which is listed as impaired just below the confluence of Eagle Creek due to exceedance of the former turbidity standard (Gila River, Eagle Creek to Bonita Creek, and Gila River, Bonita Creek to Yuma Creek). This indicated a potential sediment problem that was improved through implementation of the project.

No TMDLs have been established for Eagle Creek or any of the associated drainages, possibly due to lack of monitoring data, the Apache-Sitgreaves National Forests established standards for bottom deposits in its Forest Plan Standards and Guidelines. Stream surveys conducted at two tributary locations in 2004 returned an exceedance of the Forest's standard for fines in riffle areas (not to exceed 20% fines). Eagle Creek did exceed the old turbidity standards.

**Project Highlights**

Major BMPs: Exclusion of cattle from Eagle Creek and other riparian areas over time will improve the restoration of proper hydrologic conditions and functions, and increase functional stream geomorphology and channel characteristics. Rotational grazing and grass banking was utilized and will ensure recovery of riparian and wetlands as well as associated uplands, reducing erosion and resultant sedimentation of all aquatic habitats. The Construction or repair of fencing and development of alternative water sources (storage tanks, troughs, solar power systems, and earthen tanks) has helped manage the livestock grazing by ensuring permanent water and habitat protection and allows the riparian area to develop to its full potential.

This project began in 2007 and did not close until April of 2011. A large portion of the watershed involved in this project is located on National Forest requiring permit modifications for all practices. A year into the project, progress was held up on three of the ranches due to a change in Forest Service management and a shortage of staffing of the Clifton Ranger District. Extensions approved by ADEQ enabled the Forest Service to complete all the environmental and cultural compliance reviews so all of the planned practices could be completed.

The Upper Eagle Creek Watershed Association and the ranchers involved in this project are committed to ongoing watershed improvement and monitoring. Their efforts have greatly improved the water quality, habitat and visual esthetics of the area. They work closely with the US Forest Service and neighboring San Carlos Apache Tribe to make continual improvements to Eagle Creek and its watershed.

**Project Evaluation**

This project was evaluated through the monitoring efforts of contracted Eastern Arizona College biology professor David J. Henson. Henson monitored the quality of water in the Creek itself as well as the change in riparian areas as practices were implemented. (Quarterly and final monitoring reports have been submitted to ADEQ)

Ranchers monitored the change in vegetation as the Best Management Practices allowed them to strategically manage livestock grazing for maximum cover on the watershed and health of the riparian areas. (Rancher monitoring data and reports has been submitted to ADEQ as they were received over the duration of the project)

Ongoing water quality monitoring that involves measurements of dissolved oxygen and pebble counts would best be done by either ADEQ or the US Forest Service as it is time consuming and cost prohibitive for individual ranchers to do this type of monitoring. Ranchers can however, monitor vegetative trends and will continue to do so as part of the management strategies for their ranches.

**Results**

Water quality achievements are best quantified in David J Henson's final report. The Upper Eagle Creek Monitoring Report 2006-2009 is available to view or download at **http://tinyurl.com/4xyqp6d.** Keeping livestock out of the Creek reduced the potential for contamination from nitrates and phosphorus due to manure. Livestock exclusion also allowed for increased riparian vegetation that acted as a sediment barrier preventing it from entering the stream resulting in healthier banks and preventing bank erosion and sloughing. This was not quantifiable due to a flood in 2009 that caused bank erosion events in several locations of the stream.

There were no new laws or ordinances put in place as a result of the monitoring or practices implemented during this project.

*Modeling Results for Nitrogen, Phosphorous, and Sediment Load Reduction*

ADEQ contracted with the University of Arizona NEMO program to perform load reduction modeling on this and other projects. Below are the modeling reduction results for nitrogen, phosphorous, and sediment load reductions.

Modeling Tool:
Automated Geospatial Watershed Assessment (AGWA), Soil and Water Assessment Tool (SWAT)

Data Sources:
30m Digital Elevation Model (DEM) acquired from USGS at http://seamless.usgs.gov
30m land cover data acquired from Southwest Regional GAP (SWReGAP) at http://earth.gis.usu.edu/swgap/mapserver/
Soils data acquired from Natural Resources Conservation Service (NRCS) at http://soildatamart.nrcs.usda.gov/usdgsm.aspx
Precipitation data acquired from National Climatic Data Center (NCDC) at http://www.ncdc.noaa.gov/oa/ncdc.html

**Combined load reduction totals for all project sites:**
*Sediment Yield – 1219.5 tons/year*
*Organic Nitrogen – 3267 lbs/year*
*Organic Phosphorous – 576.6 lbs/year*

Project Site Area 1- Mud Springs/East Eagle Allotments:
A simulated 30m buffer of vegetative ground cover representing the recovery of riparian areas as a result of exclusionary fencing was added to the model along approximately 4.8 miles of Eagle Creek. Load reduction results for the BMPs implemented in Area 1 are as follows:
Sediment Yield - 93.9 tons/year

Organic Nitrogen - 266.1 lbs/year
Organic Phosphorous - 29.6 lbs/year

Project Site Area 2- AD Bar/Hogtrail Allotments:
Three polygons totaling nearly 2100 acres that correspond to prescribed burn areas were added to the simulation representing the impaired land cover before the implementation of BMPs. Another model was run simulating the recovery of natural vegetation in the burn areas, and the Area 2 load reduction results are as follows:
Sediment Yield – 210.6 tons/year
Organic Nitrogen – 1129.8 lbs/year
Organic Phosphorous – 157.1 lbs/year

Project Site Area 3- Baseline/Horsesprings Allotments:
A simulated 30m buffer of vegetative ground cover representing the recovery of riparian areas as a result of exclusionary fencing was added to the model along approximately 3.5 miles of Eagle Creek.

Load reduction results for the BMPs implemented in Area 3 are as follows:
Sediment Yield – 617.2 tons/year
Organic Nitrogen – 1655.7 lbs/year
Organic Phosphorous – 207 lbs/year

Project Site Area 4- Tule Allotment:
A simulated 30m buffer of vegetative ground cover representing the recovery of riparian areas as a result of exclusionary fencing was added to the model along approximately 1.9 miles of Eagle Creek.
Load reduction results for the BMPs implemented in Area 4 are as follows:
Sediment Yield – 290.4 tons/year
Organic Nitrogen – 1097.7 lbs/year
Organic Phosphorous – 182.9 lbs/year

Project Site Area 5- Double Circle Allotment:
A simulated 30m buffer of vegetative ground cover representing the recovery of riparian areas as a result of exclusionary fencing was added to the model along approximately 1.5 miles of Eagle Creek.
Load reduction results for the BMPs implemented in Area 5 are as follows:
Sediment Yield – 7.4 tons/year
Organic Nitrogen – 32.5 lbs/year
Organic Phosphorous – *none*

**Partners and Funding**

319h funding of $360,930.00 was used primarily to install best management practices focusing on fencing to manage livestock with the goal of improving water quality in Upper Eagle Creek. Approximately $35,000.00 was utilized to develop and implement a monitoring system to monitor the impacts of this project and for long term monitoring of watershed and creek health.

Each of the ranchers provided project oversight and many hours of in kind labor for practice installation and monitoring. The ranches involved in this project were: 4 Drag Ranch- Gary & Darcy Ely, Tule Ranch- Twig & Shirley Winkle, Powder River Ranch- Chase Caldwell, Anchor Ranch- Jim & Clarice Holder and Double Circle Ranch- Wilma Jenkins & Doug Dressler.

The US Forest Service provided technical assistance in the planning, permit modifications, on the ground cultural and environmental evaluations and clearances and approval and

certification of practice installation. (None of the federal time from the USFS was used as a matching contribution to this project)

USDA-NRCS EQIP dollars were used to install additional sections of fence to divide pastures to improve management of livestock. (These are federal dollars and not used as a matching contribution to the project) The following tasks associated with the upper Eagle Creek Watershed Projects were leveraged with EQIP Funds:

> 2006 NRCS $35,370 Funded the rebuild with HDPE pipe an existing 3.5 mile pipeline from the new ADA Solar Pumping System for additional storage and coverage for new water sources.
>
> 2008 NRCS $27,500 Funded mechanical thinning on NO Bar Mesa as part of the USFS prescribed burn in 2008 of 10,000 acres of the Double Circle Ranch for the creation of a wildlife corridor from the Blue River to Eagle Greek.

Arizona Department of Agriculture contributed funding on each of the ranches to enhance water systems that support pasture divisions. The practices included wells, pipelines and troughs to provide water to the new pastures and eliminate the need for utilizing Eagle Creek for livestock water. The following Upper Eagle Creek Watershed Projects tasks were leveraged with ADA Funds:

> 2005 ADA LCCGP $125,000 Constructed the Double Circle Solar Water Pumping System which provides water storage and multiple troughs allowing grazing without having to use Eagle Creek and Sheep Wash for water sources on the west side of the ranch.
>
> 2007 ADA LCCGP $125,000 Constructed the NO Bar Solar Water Pumping System which provides water storage and water troughs allowing grazing without using Smith Canyon or Sheep Wash for Water sources on the east side of the ranch.
>
> 2009 ADA LCCGP $100,000 Constructed 7.3 miles of boundary and division fences for our rotational grazing practices and funded additional HDPE pipe for the NO Bar Solar System.
>
> 2011 ADA LCCGP $100,000 for construction of additional boundary and division fences allowing rotational grazing.

**Aspects of the Project that Worked Well:**
The technical aspects of installing the Best Management Practices worked well. The ranchers in this area are conscientious and very interested in improving the health of their watershed. Ranchers completed practices in a timely manner and reports with documentation were also submitted on time.

**Aspects of the Project that Did Not Work Well:**
The most challenging aspect of this project was the delays that occurred in implementing the project due to the personnel changes and lack of staff at the Clifton Ranger District of the US Forest Service. This delayed a portion of the project making monitoring less accurate than it could have been if all practices had been installed in the first year rather than over a period of five years.

**Ways to Improve Aspects that Did Not Work Well:**
Future projects should have all of the permit modifications in place before undertaking a grant application. This had not been an issue on prior projects but a staffing change made a big difference in what the permitees were able to accomplish within a grant time line.

**Future Activity Recommendations for the Watershed**

This watershed has a very progressive watershed association that is planning for future improvements that will insure long term health of the area. All of the ranchers are active in monitoring their allotments and work closely with the Forest Service and each other for the good of the watershed. There are more fences and water systems needed as well as clean up of abandoned or burned fence lines and a boundary fence should be installed between the Forest Service and Apache Tribal land along with improved waters and pasture divisions on the San Carlos Apache grazing land.


*Upper Eagle Creek Alternative Water System (tank and trough) Installation Process*

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## 2. In-Progress Project Success Story: ADEQ Grant #11-T01/ Upper Granite Creek Targeted Watershed Grant

**Submitted by: Amanda Richardson, Prescott Creeks Preservation Association**

### Project Summary

The Upper Granite Creek Watershed is located in Prescott, Arizona in the headwaters of Verde River Watershed. It is the focus of a Targeted Watershed Improvement Planning (TWIP) effort led by Prescott Creeks and the Granite Creek Watershed Improvement Council, a body of local stakeholders. This project originated as a community-driven watershed survey and planning effort to address nutrient and bacteria water quality concerns in the watershed. The Upper Granite Creek Watershed was identified by ADEQ as a priority for TWIP development based on water quality standard exceedances in both Granite Creek and Watson Lake, resulting in 303 (d) Impairment designations for low dissolved oxygen (Granite Creek and Watson Lake, 2004), nutrients and pH (Watson Lake, 2004) and *E. coli* bacteria (Granite Creek and Watson Lake, expected 2012) by ADEQ.

The goal of the Granite Creek Watershed Improvement Plan is to improve water quality in local creeks and lakes so that all water bodies meet state water quality standards. Project objectives include: 1) identifying primary sources of nutrients and *E. coli* bacteria in the watershed, and 2) developing a plan to reduce the pollutant concentrations entering surface waters. A Watershed Improvement Plan for the Upper Granite Creek Watershed is the final product. The plan establishes a list of priority water quality improvement and education projects, or best management practices (BMPs) that can be implemented by local stakeholders (residents, landowners, municipalities, government agencies, etc.) to achieve the desired result of reducing the nutrient and bacteria concentrations in our surface waters. The final plan also will address long-term funding strategies to ensure ongoing BMP implementation, management and sustainability.

### Project Evaluation

Since this project in still in progress, a final evaluation has not yet occurred. However, the WIC has continually performed self-assessments by tracking project milestones and predicted outcomes and comparing them with actual project progression. This has allowed to WIC to self-correct along the way, and has resulted in changes to increase public involvement and interaction in the plan writing process and critical evaluation of data interpretation methods. Project evaluation continues to be in the forefront as project progresses.

### Results & Outcomes

Between 2009 and 2011, the Granite Creek Watershed Improvement Council met on a monthly basis. To better understand the condition of the Upper Granite Creek Watershed and identify sources of excess nutrients and bacteria causing water quality impairments, efforts were undertaken as part of the WIP process to collect various types of data. These efforts included water quality monitoring with local citizen scientists; a riparian buffer assessment; watershed field survey with local community members; and a social survey of watershed residents. Each dataset was analyzed individually for what it reveals about the condition of the watershed; the datasets were then combined and analyzed for a more comprehensive analysis of the watershed.

<u>Water Quality Monitoring</u>
Creek Crew volunteers collected samples for Nitrate/Nitrite, Total Phosphorus, TKN, Ammonia, *E. coli*, and *Bacteroides* DNA testing at 19 sites around the watershed. ADEQ sampling data from 2000-2010 was also included in the data analysis.

Findings to-date:

- Levels of nutrients and bacteria exceed state water quality standards during high stream flow and runoff from precipitation.
- Low dissolved oxygen levels in Granite Creek (originally believed to indicate nutrient loading) occur only during lower flows – not when nutrients or bacteria exceeded standards. Low dissolved oxygen is likely related either to natural groundwater upwelling and stagnant pools as the creek flows dry to a trickle.
- Exceedances of state water quality standards during high stream flows seem to indicate that the nutrients and bacteria are the result of many sources.
- High nutrient and bacteria levels during runoff events may indicate that riparian areas along the creeks are not functioning properly because they should intercept surface flow and filter out pollutants. This may be due to degraded riparian condition and also because hard (impervious) surfaces and engineering have routed stormwater directly into the stream, thereby avoiding the natural riparian filters.
- Bacterial pollution is more widespread in the watershed than nutrient pollution based on the number of samples exceeding water quality standards.
- As of May 2011, *Bacteroides* DNA testing has yielded results only as presence-absence. Seventy-eight percent of the samples (N=23) collected within the project area were positive for the human genetic marker, meaning that human bacteria were present in those samples. Without quantification of the human bacteria found in the samples, we are unable to discern whether human bacteria is a significant portion of the bacteria in a sample and, therefore, at which locations human sources may be a serious impact to water quality. The presence of the human molecular marker may indicate that human recreation or improperly treated/disposed sewage or septage is currently impacting water quality in the watershed near those sampling locations. Quantification is needed before drawing conclusions about human sources of bacteria from this data.

*Creek Crew volunteers collecting data*

Watershed Field Survey

Creek Crew volunteers walked 16.5 miles of stream in the Upper Granite Creek Watershed from March 27 to July 28, 2010 to systematically document sources and causes of excess nutrients and *E. coli* bacteria in Granite Creek and its tributaries. Nearly ¾ of the creek segments were visited on March 27th during a full day training and field event. The field survey focused on the developed portion of the watershed and documented stormwater drainage features; riparian buffer impacts; and other pollution "hot spots." Volunteers collected data at 328 impact sites.

*Creek Crew volunteers*

Riparian Buffer Assessment

A rapid vegetation assessment and physical survey of the Upper Granite Creek Watershed was undertaken to assess the current functionality of the watershed channels in terms of their ability to filter pollutants from runoff. This assessment was completed by Dr. Marc Baker of Southwest Botanical Research of Chino Valley, AZ. Properly functioning riparian areas should be able to slow down surface runoff and filter out both nutrients and *E. coli* bacteria, which are pollutants of concern in this watershed. Each transect was given a riparian score based on the percent of vegetation encountered along the transect, diversity of vegetation classes, slope, and surface roughness. Each transect was also given a bare soil score based on percent of bare soil along a transect. Transects receiving the highest and lowest riparian scores are scattered across the watershed, appearing in both the urban and forested areas. The highest and lowest scoring transects are *not* segregated by land use even though the upper portion of the watershed (the forest) should be less affected by human activities. Riparian impacts are not isolated to only a couple of streams. Poor riparian conditions can appear adjacent to the best riparian conditions.

**High Bare Soil Scores**

Transects along Banning Creek (left) and Granite Creek (right) received some of the *highest bare soil scores*. Contrasted with the photos below, these photos show less ground cover and more exposed soil and rock.


**Low Bare Soil Scores**

Transects along Manzanita Creek (left) and Granite Creek (right) received some of the *lowest bare soil scores*. These photos portray transects where ground cover—vegetation, litter, or duff—was prominent.

Social Survey

A social survey of residents within the Upper Granite Creek Watershed was conducted between December 15, 2009 and March 15, 2010. The survey was designed to gather information about watershed residents' knowledge of watershed and water quality issues; perceptions of water quality; attitudes and values about protection and restoration of local water ways; and environmental behaviors. The goal of the survey was to identify gaps in public knowledge and to develop an outreach and education strategy (outlined in Chapter 3) to accompany the WIP and project implementation.

1,482 responses were received. General findings revealed strong support for the protection and restoration of our waterways and willingness to pay a fee to support watershed management activities. The survey also revealed some confusion on pollution sources, especially for difficult-to-perceive non-point sources.

**Aspects that Have Worked Well:**

The all-volunteer WIC continues to meet monthly, sometimes more frequently. The WIC member entities see this project as an opportunity to address a complex, widespread issue and the benefits of working collaboratively.

The community has a strong interest in getting involved. Activities that required volunteers were well-attended. These activities served as unique educational opportunities.

The objective, scientific approach to local water quality issues has, for the most part, helped to keep the past political divisiveness on these issues at bay. This means that overall, the process has been quite productive.

**Aspects that Have Not Worked Well:**

As with all new collaborative efforts, extensive time was required to build relationships and trust, to educate a group of people from different backgrounds and specialties, and to facilitate collaborative decision-making. The original timeline set forth for the project did not allow sufficient time to build the collaboration or to work with technical resources.

With no formal commitment from the entities represented on the WIC, it can be a challenge to keep members engaged. There is also some question of buy-in and long-term commitment to implementing the WIP.

**Public involvement and coordination:**
Public involvement is an integral part of every Prescott Creeks project, but has been especially important to the Watershed Improvement Project. A large part of this project has been overseen by the Watershed Improvement Council, made up of representatives from stakeholder organizations (City of Prescott, Yavapai County, etc…) and members of the community. These community members have represented creek-side homeowners, businesses, and the general public. They have contributed feedback from their perspective and also their specialized skills; such as statistical analysis.

One of the largest pieces of public involvement was the social survey. This survey was designed to better gauge the public's knowledge of and interest in water quality. The mail survey reached 21,000 households through the City of Prescott's utility bill and 30,000 people through Valpak Neighborhood Trading Areas for Prescott, which includes several communities outside the watershed. The survey was also available online. 1,482 people responded to survey (~3%).

Volunteers have also been involved in the field survey, water quality monitoring, input and analysis of the social survey, and determining water quality priorities for the future monitoring. Although this project took oversight from Prescott Creeks, and specifically Amanda Richardson, it would not have been possible without the support and involvement of the community.

**Future Activity Recommendations for the Watershed**

An 18-month extension was granted in order to achieve the original intent of the WIP to identify specific sources, project sites, and BMPs to mitigate pollutant loading. Those objectives were not achieved within the originally established timeline due to natural conditions and the inherent complexity of a project of a collaborative nature.

Further investigation within the priority subwatersheds is necessary before specific BMPs and locations can be identified:

Targeted water quality monitoring
Water quality data collected to-date has not yielded the conclusive identification of primary pollution sources around the watershed. As determined by the WIC in coordination with ADEQ staff, additional targeted water quality monitoring is a necessary task to provide the site and source specificity needed to advance BMP design and project locations with greater confidence at achieving goals in Phase II. In addition to targeted monitoring for bacteria and nutrients, where human sources are suspected to be primary sources, *Bacteroides* samples are needed as part of the monitoring suite.

Sustainable Funding for Watershed Improvements (Financial Survey)
As part of a financial survey to identify funding sources for the recommended BMPs, the WIC recommends that continuous, local funding sources be developed to ensure continued investments in watershed health. Funding could be collected through a "watershed protection fee" paid by individual property owners based on the amount of impervious cover and expected runoff volumes of a property. The Watershed Residents' Survey of 2010 found that the majority of respondents supported a fee that would address local water quality and watershed issues. Coordination with stakeholders (City, County, etc.), research, and development of public support are necessary before implementation of such a fee. Determination of the appropriate entity to collect, manage and disperse the funds will be a significant endeavor as there are multiple jurisdictions within the watershed.

Public Education and Engagement
Watershed-awareness among the populace and local policymakers is crucial to achievement of the goals set forth in the WIP. The WIC recommends specific education and outreach tasks to raise public awareness. To support community buy-in to the final WIP, the WIC will hold

community workshops, encouraging the participation of broad watershed stakeholders. Ideally, these workshops will be held in conjunction with the ADEQ-led Total Maximum Daily Load analysis (TMDL) effort in the watershed, and/or the workshops could build from the state meetings (depending upon coordination of timelines). The WIC will develop a "Creek Care Guide" generally applicable to central Arizona and specifically applicable to the Granite Creek Watershed. The Guide will be used as a tool at public workshops and will be distributed to local property owners and the public. The Creek Care Guide will provide property owners and residents with practical and locally relevant strategies they can implement to help maintain and improve watershed health and healthy stream function. This, in turn, will protect and/or enhance homeowner land and property values.